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EXPERIMENT STATION RECORD,

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EXPERIMENT STATION RECORD.

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During the past winter the State legislatures of Maine and Massachusetts passed acts providing for a control of the sale of concentrated commercial feeding stuffs, similar in object to the fertilizer control. A law which has been in force in Connecticut for more than two years is considerably wider in its scope, including provisions to prevent adulteration or misbranding of "every article used for food or drink by man, horses, or cattle."

The step taken by these three States commends itself from several points of view, and will be a valuable safeguard to farmers and stock feeders. The variation in composition of well-known feeding stuffs is very large, as will be apparent from a perusal of any of the compilations of analyses. Wheat bran, for example, varies in protein all the way from 12 to 19 per cent; wheat middlings, from 10 to 20 per cent; wheat screenings, from 8 to 17 per cent, and buckwheat middlings, from 25 to 31 per cent. Cotton-seed meal ranges from 23 to 50 per cent in protein and from 9 to 18 per cent in fat; new-process linseed meal, from 27 to 38 per cent in protein and from 1.3 to 4.4 per cent in fat; peanut meal, from 37 to 52 per cent in protein and from 6 to 18 per cent in fat; and the various materials sold under the name of gluten meal have been found to vary from 21 to 39 per cent in protein and from 6 to 20 per cent in fat. A part of this variation is due to differences in water content, but even on the dry-matter basis the range in composition is very wide. This is but natural, since the by-products are obtained from a large number of factories, and a difference or a change in the process of manufacture has its effect on the composition of the by-product. These feeding stuffs are usually quite expensive, and the arguments for a fertilizer control apply with equal force in the case of concentrated feeding stuffs. The farmer may be paying $20 per ton for gluten meal with 35 per cent of protein in one case, and the same amount for another shipment with only 25 per cent, or even less. He can not afford to take the risk in buying high-priced commercial feeding stuffs by name only any more than in buying fertilizers; and if in the absence of a guaranty or control he sends a sample of a feeding stuff to his experiment station the chances are that the particular lot sampled will be sold before the report of the analysis is received.

Again, the greatest confusion prevails as to the nomenclature of certain classes of by-products sold as feeding stuffs. A few years ago a by-product in the manufacture of glucose from corn was placed upon the market and soon met with a ready sale. The material varied considerably with the process of manufacture, as noted above, and certain trade names were given to the product from different factories. As a result we soon had not only various brands of "gluten meal," but also "glucose meal," "cream gluten," "gluten flour," "gluten feed," "grano gluten" (which is dried distillery refuse), "glucose feed," "glucose refuse," "sugar feed," "sugar meal," "maize feed," "corn germ," "corn-germ meal," and even others. The confusion was complete. Only a person familiar with the process of manufacture could tell to what class the different materials belonged, and as they ranged in protein all the way from less than 10 to over 35 per cent there was a chance for great deception or misunderstanding. The case is similar with cotton-seed meal and the newer "cotton-seed feed." Although different in appearance, the purchaser is likely to be misled by the name and to think the mixture of cotton-seed meal and hulls a richer feeding stuff than it really is.

Finally, the feeding-stuffs control acts as a preventive of adulteration, intentional or otherwise. When a guaranty of composition is required, there is no temptation to adulterate with foreign substances or a cheaper grade of materials, and there is less likelihood of deceptive trade names being used. In this country not much is heard of adulteration of feeding stuffs, and very little has been done in studying their purity at the experiment stations further than determining the composition by analysis. How much of the variation observed is due to adulteration or to deceptive practice in manufacture it is impossible to say. There is little positive ground, however, for suspecting manufacturers of intentional adulteration of this class of materials.

In Europe, where considerable attention has been paid to studying the purity of feeding stuffs, some remarkable cases of adulteration have been disclosed. The brans have so frequently been found to be adulterated that the German stations are continually cautioning their constituents against buying wheat or rye brans except on a guaranty of composition. In some sections nearly all the bran has been found to be adulterated. The admixtures consisted of sweepings, finely ground oat chaff, ground peanut hulls, sand, large quantities of weed seeds, etc. Other classes of concentrated feeding stuffs have been found to be extensively adulterated, and also to contain injurious weed seeds, as ergot, molds, and other fungi, and to be in bad condition. It is said that in general adulteration and contamination of commercial feeding stuffs are much more common in Germany than in the case of commercial fertilizers. A voluntary control has been arranged in Germany by which the principal dealers in concentrated feeding stuffs place themselves under the control of the stations and agree to give a rebate on a fixed scale in case their goods are found to be below the guaranty. But the need of a more comprehensive and binding plan is keenly felt by the German stations.

The action of these States is in the right direction and is unmistakably a mark of progress. It should lead to successful agitation in other States which will ultimately add to the general security of farmers in buying concentrated feeding stuffs, a practice becoming more extensive as the advantage of feeding better-balanced rations is realized.

AGRICULTURAL ASSOCIATIONS IN BELGIUM.

P. de Vuyst,

Assistant Inspector of Agriculture of Belgium.

Agricultural associations were not regarded with much favor by the Belgian farmers until within the last ten years. The Government has, however, for some time understood the advantages of such organizations, and as early as 1848 had organized local agricultural societies (*comices*) in districts where no other agricultural associations existed. These local societies were designed to encourage agricultural meetings, to introduce such improvements as were suggested by experiments, and to assist in the formation of provincial agricultural commissions. The existing agricultural associations in almost all the districts identified themselves with the local societies, with the result that in a short time an official organization uniform throughout the Kingdom was created. This official organization has, however, not been able to cope with the agricultural crisis which in recent years has so severely affected the country. A great number of associations have, however, been formed under private auspices. These associations have multiplied more rapidly during the last 3 or 4 years, since socialism has threatened to invade the rural districts. Unofficial associations will be fully treated later.

In Belgium, as a rule, the farms are very small, not averaging more than 3 hectares in extent (7.4 acres). Under such conditions agricultural associations are more indispensable than elsewhere. Without their help progress in such lines as the breeding of cattle, the improvement of seeds, or the use of improved implements is absolutely impossible. Belgian farmers are beginning to understand this, and if they continue in the course upon which they have entered, they will doubtless succeed in extricating themselves from the difficult situation in which they are now placed.

THE LOCAL AGRICULTURAL SOCIETIES (COMICES).

The local agricultural societies are groups of farmers and other persons interested in agriculture. They are charged with watching over the agricultural interests of a particular region, which as a rule corresponds with the judicial district. They receive a subsidy from the General Government and also from the province in which they are located. These societies in return must furnish miscellaneous information regarding agricultural matters and must make an annual report on the condition of agriculture in their respective districts. As before stated, these local societies were established in 1848. They were reorganized in 1889 for the purpose of adapting them to existing conditions and enabling them to render better service than before. The result has, however, been disappointing. The law of 1889 has not produced any essential change in the original organization. The International Congress of Agriculture at its session last year in Brussels urged the necessity for further improvements.

ORGANIZATION AND OBJECT.

At least 50 active members are required to form a local society. A common fund is formed by contributions from the members and this is augmented by subsidies from the general and provincial governments. The purpose of this fund is to provide for the expenses of administration, for the organization of farmers' meetings, and for the dissemination of improved methods of agriculture within the district. Wherever practicable the General Government provides "a field of demonstration" for each local society. Each member receives the official agricultural journal of the society. Each society is directed by an executive committee, generally composed of 7 members, including a president, 2 vice-presidents, and a secretary and treasurer. Only one officer, the secretary and treasurer, receives compensation. The committee is renewed in part each year by vote of the society. The committee attends to the administration of the society under the supervision of a provincial commission of agriculture. This provincial commission consists of the executive committee of the provincial assembly of delegates. The latter body is made up of 2 delegates from each local society. The assembly of delegates representing the provincial federation examines and approves the accounts and other affairs of the different local societies and allots the subsidies of the State and those of the provinces. Its executive committee, *i. e.*, the provincial commission, carries out the decisions of the assembly of delegates, transacts routine business, assists in the collection of agricultural statistics, etc. Each provincial federation elects 2 delegates. These, together with the members nominated directly by the Minister of Agriculture, form a superior council of agriculture. This council devotes its attention to all measures which concern the progress of national agriculture. It gives advice in business matters regarding which the Government has conferred upon it the right of examination. It deliberates on all propositions relating to agriculture which are submitted to it by the provincial federation or by members of the council. The official organization therefore includes three bodies (1) the local societies, (2) the provincial federation, and (3) the superior council. There are about 150 local societies grouped into 9 provincial federations. They include about 30,000 members, averaging about 200 for each local society. Supposing that each member represents one farm, the local societies now existing would represent only about 3 per cent of the 900,000 farms of Belgium.

WORK.

Generally speaking the work of the local societies is to encourage progress and disseminate knowledge, (1) by agricultural fairs with competitive awards, (2) by experimenting, (3) by congresses and conventions, and (4) by means of agricultural journals.

Agricultural fairs.—Most of the local societies devote the greater part of their limited resources to fairs. They are held every 3, 4, or 5 years, or in some places not oftener than once in 10 years. During the intervals practically nothing is done. This was especially true before the reorganization of the societies in 1889. But in spite of the law then passed and the proclamation of the Department of Agriculture in 1892 a number of local societies have continued to follow their old system. These fairs are much like those of other countries. They include exhibitions of animals and agricultural products and implements. Sometimes they are of considerable interest, and they doubtless have some influence upon agricultural progress. It is, however, a question whether the sums expended upon them could not be used to better purpose. If the programmes were more carefully planned it would be a different matter, but the practical side of the question is generally neglected. The work of the fairs is too superficial. Fat stock or animals of attractive appearance and large specimens of agricultural products too often receive premiums, while the best methods of cattle breeding and the value of agricultural products from a scientific and economical standpoint are not sufficiently considered. The awarding of prizes is often not carefully done. It is usually privileged persons who receive the premiums and the progress of agriculture is not generally assisted. Fairs conducted in this way neither encourage nor instruct the mass of farmers.

The minister of agriculture, M. de Bruyn, shares the above opinions. In a circular issued in 1892 he says in effect: I am convinced that the criticisms which have been made of the agricultural fairs are not without foundation. The programmes followed out do not lay sufficient stress on local needs. Their greatest fault is that they are not sufficiently restricted. They sometimes embrace the whole subject of rural economy and no one branch is materially benefited. Practical instruction must have a decided influence on the future of agriculture. It is therefore the duty of the local societies to pay particular attention to practical demonstrations for the farmers, to call attention to favorable results which have been obtained by experimenters, and to explain the reasons for them. It is also necessary to avoid the error made by some local societies of devoting all their attention to one branch of farming or to certain special local conditions.

Several societies have already followed the lines of improvement indicated by M. de Bruyn. For instance, the society of Kemmel has improved the culture and drying of hops, the society of Grammont has endeavored to improve the culture of tobacco, that of Courtrai has given attention to the improvement of agricultural implements and to teaching the farmers the relative merits of different kinds. Other local societies have turned their attention to dairying and milling, while still others have given premiums for the preparation of popular pamphlets. Such instances are encouraging, and it is hoped that they will become more numerous.

Fairs or expositions covering a wide field will soon be given only under the auspices of the provincial federations. Such expositions are proper when it is desirable to give a true idea of agriculture and agricultural conditions in a certain region of the country. The resources available for these expositions are amply sufficient, since the local societies are aided by two or three provincial federations and in addition by special subsidies from the State, the province, and the town. Moreover, the Government possesses considerable material useful in arranging exhibits. This is available for expositions and greatly reduces their cost.

The general plan of these provincial exhibits is, however, not altogether satisfactory. They are usually not sufficiently practical and not always abreast of the times. Then, too, they often lack unity of purpose. Premiums are still offered for exhibits in which size is a more important factor than worth. No one doubts that it would be better to offer a prize for a small number of varieties of grain, for instance, which had been experimented with under definite conditions, than for a large number with which this was not the case. Another criticism is that too large awards are given to manufacturers on the plea that the expenses attendant upon their exhibits are very great. Large breeders are also favored to the disadvantage of the small farmer. It would be much better to encourage coöperation among the farmers, since this is a more potent factor in progress than individual interest.

Though some provincial expositions, notably that of Bruges in 1894, have followed these lines of improvement, the promoters of others have been apparently too careless to do so. The creation of a central and permanent commission technically competent to manage affairs might improve existing conditions, and such a commission could be selected from the superior council of agriculture.

Experiments.—According to official instructions each provincial federation and each local society must have an experimental field. M. Proost, the inspector general of agriculture, has general technical supervision of this work. The plan is that the experiments shall be carried out by the provincial federation, and that demonstrations of the experiments be made by the local societies in their experimental fields. The soils of the province are studied, as well as new varieties of plants and new methods of fertilizing, with a view to their use in the fields of demonstration.

Well-organized experimental fields are at present found in only two provinces, one in Ghent in East Flanders and the other at Hasselt in

Limbourg, both of which are under the direction of a state agriculturist.[1]

The first of these publishes each year, as a supplement to the annual report of the provincial commission, an account[2] of the experiments which have been carried on. The second, which has devoted its attention to studies of the local soil, also publishes reports [3] of its investigations. If this latter example were followed by other provinces, there would soon result a complete report on Belgium soils and their needs.

The Ministry of Agriculture of the General Government was founded in 1884, and the experimental fields date from this time. At first each experimenter, on application to the Ministry of Agriculture, received fertilizers and seeds free. The experiments were required to be made under the direction of a state agriculturist and on an experimental field not exceeding 20 ares (about one-half acre). When the local societies were reorganized in 1889, it was decided by the Government that each should have a field of demonstration near it. This measure was adopted to insure the speedy application of the results of the experiments, and it was also believed that having a number of fields for purposes of demonstration would diminish the number of printed reports which were necessary.

The experimental fields have rendered great service in disseminating information regarding the use of fertilizers and improved varieties of plants. So far the plan has been fairly successful. It appears desirable, however, to so modify it that better results may be obtained both from a scientific and an economic standpoint. This modification would necessitate a carefully considered plan of coöperation, closer relations between the state agriculturists and the local societies, and compensation for the persons actually engaged in carrying on the experiments.

Meetings.—Frequent meetings with addresses by competent men furnish a valuable means of diffusing knowledge of agricultural science among farmers. The report of M. Cartuyvels, director of agriculture at the third international congress in Brussels, indicates that these meetings are not always well managed by the local societies. Sometimes the members meet only once a year, namely, for the election of officers. Frequently the local societies meet only in the principal cities of the district instead of in the country towns. The result is that politicians and others join the associations and use them to serve their own ends. It is not, therefore, surprising that the farmers do not attend these meetings when held in large cities.

The agricultural conferences held each year under the auspices of the Government in the rural communities are, however, well attended.[4]

[1] M. de Caluwe is director of the first and M. Schreiber, assisted by M. Smets, of the second.

[2] Société agricole de la Flandre orientale. Rapports sur l'état de l'agriculture dans la province, etc., de Gand.

[3] Monographies agricoles des terrains du Limbourg, Hasselt.

[4] For an account of this feature of the subject, see E. S. R., 4, p. 707.

These meetings are doubtless made more attractive than local affairs. Though the addresses are delivered by experts, they are on subjects of real interest to the farmers.

Publications.—A large portion of the resources of the local societies is expended on agricultural journals, which are sent to every member. Nearly every province has its own journal. These give reports of the meetings and publish official information and general articles on agricultural subjects. These various journals[1] differ in value, though in general they are of great benefit to their readers. Unfortunately, in Belgium, as in other European countries, farmers who read are rare.

As has been before stated, only 3 per cent of the Belgian farmers are members of the local societies, and it is probable that not more than one-third of the members read carefully the agricultural journals. Most of the provincial federations publish an annual report which contains statistical information on agriculture. When the provincial federations do not publish such a report, the material which it would be made up of is used in compiling the bulletin of agriculture, published by the Ministry of Agriculture, which gives a general summary for the whole country. The system of publications is capable of considerable improvement.

General remarks on the work of the societies.—The majority of the local societies confine their attention to the four points above noted. The circular issued by the Government in 1892, previously referred to, urges them to strive for increased yield of crops, to form coöperative societies, to improve the land already in cultivation, to coöperate in the purchase of such implements as are too expensive for the individual farmer, to assist the farmers in the selection of proper varieties of seeds, to endeavor to improve the breeds of cattle, and to more frequently consult the state agriculturists.

The fact that the local societies do not carry out the suggestions of this circular may probably be attributed to the indifference and sometimes the incompetency of the governing boards and the expense attendant upon membership in the local societies. The work of the governing boards is almost all done by the secretary. Since the organizations depend largely upon subsidies from the Government, it would be proper for the Government to appoint secretaries, selecting competent men, and rendering them assistance through the state agriculturists. The inefficiency of the governing boards is increased by the interference of persons not familiar with agricultural matters. To remedy this, as suggested by the provincial council of Liége in 1894, only persons who have either a practical or theoretical knowledge of subjects connected with agriculture should be allowed to take part in the meetings of the

[1]De Landman, Bruges; De Landbode, Brussels; De Landbowgalm, Courtrai; Journal de la société agricole du Brabant-Hainaut, Brussels; Het Landbouwblad, Hasselt; Journal de la Société royale agricole de l'Est, Liége; L'agronome, Namur; Le Luxembourgeois, Arlon.

societies. If the societies were more scientific in their character and nonpolitical they would be able to gain the influence of other organizations when they wish subsidies from the State.

It is very desirable that all persons connected with agriculture should be members of the societies. As the matter stands, membership is too expensive for many of the small farmers. However, there is no good reason why the expenses of membership should not be reduced for this class, without at the same time increasing the cost to the classes having more means or those interested in experimental research. The abolition of fees for the small farmers would be equivalent to depriving them of the agricultural journals, which are the best means of disseminating agricultural knowledge. It would doubtless be advisable to require no fees from the farm laborers. They have less need of the agricultural journals, and it would probably be sufficient to furnish them with notices of the dates and places of meetings, etc. Such information could be sent under the franking privilege and its cost would be insignificant.

If these plans were followed out the ground for criticism of the local societies would doubtless disappear. Practically the same ideas were embodied in a resolution adopted at the third international agricultural congress in Brussels. The resolution urged the need of carefully prepared by-laws for the government of the societies, of more unity of action, and the advisability of their affiliation with other organizations.

THE AGRICULTURAL SOCIETY OF HERZELE.

The local society of Herzele may be cited to show what has been accomplished by some of the more progressive societies. This society is an organization of recent date. Its work has been described in several publications.[1] In considering its work it must be remembered that the local agricultural conditions are unfavorable and that it is difficult to introduce improvements. The farmers have little means and the people are poorly educated and nonprogressive. Herzele is situated outside the region where tobacco, sugar beets, chicory, and hops are cultivated; forestry receives little attention, and the use of fertilizers is not general. The farmers are obliged to depend upon products which yield small profits, such as grain and butter. Improvements could not be introduced as readily or as rapidly as in regions where the farmers are better instructed or where there is more capital and the local conditions are more favorable. The local society of Herzele therefore sought to introduce improvements suited to the locality.

A reduction of the expenses of membership for the small farmers has been made possible by generous contributions from the more well-to-do

[1] Revue agronomique de Louvain, 1894, p. 195; Journal d'agriculture, Paris, 1896, p. 706; Congrès international d'agriculture, rapports préliminaire, Brussels, 1895, p. 822.

members. Monthly meetings are provided for in all the communities, as well as visits to the fields of demonstration and agricultural excursions. The formation of a local society in each village is urged, the governing board of the local society to be made up from delegates from the different villages. Affiliation with other agricultural societies is also urged, the representatives of these societies being admitted to membership in the governing board. In this way the governing board has a better view of the whole situation. To encourage the formation of new societies a prize of 50 francs is offered each year for the first society formed during the year. The work which has been done by the local society of Herzele and affiliated societies may be briefly described as follows:

In the first place statistics of the region were collected. It was learned that in the district there were 9,043 hectares (22,346 acres) of cultivated land, and about one-fourth of the whole district was pasture land. The milch cows numbered 2,990, and the horses 744. The milk industry was regarded as the most prosperous. It was further found that the 9,043 hectares of land was divided into 6,328 farms, an average of 1.2 hectares (about 3 acres) to the farm. It will be seen that the single farmer is helpless and that coöperation is essential.

In view of the information furnished by the statistics the local society undertook (1) to increase the profits of the farmers in the different lines of agriculture followed by carrying on experiments and by other means, (2) to relieve the farmers of unnecessary expense in the purchase of goods, (3) to devise plans for insurance, (4) to disseminate information relating to agriculture, and (5) to arbitrate in case of misunderstandings between members.

Increase of profits.—To increase the profits it was necessary to learn the resources of the region. Experiments were therefore carried on on experimental plats and in the open field. Since the soils throughout the region are very similar the latter were largely devoted to determining, under ordinary conditions of culture, the best kind and the quantity of fertilizers to be used, and the order of rotation of crops. Experiments were also made to learn the best varieties of plants and grains and the best methods of culture. The experiments were made in duplicate, and have covered a period of three years. Those who have undertaken them were small farmers who employ no laborers but attend to all the details in person. The fact that they themselves are the first to benefit from the experiments gives them a special interest in them. They are subject to inspection, and receive premiums which are proportional to the pains they have taken to carry out the instructions given. During the last seven years 500 pot culture experiments have been made for the study of the soil. Preliminary variety tests on 1,394 plats, and 2,381 field experiments have also been made. It will be seen that this represents an immense amount of work.

Experiments with commercial fertilizers have yielded the district a maximum profit of 500,000 francs ($100,000). In addition, the use of improved varieties, the selection of the best methods of culture, and the experience gained will increase the annual production at least 15 per cent over that obtained when ordinary unimproved varieties were cultivated by the usual methods. This will bring the total profit up to 900,000 francs ($180,000). It is generally conceded that in Belgium the total annual value of the agricultural products approximates a billion francs ($200,000,000), and that this value can be increased about one-fifth. Nearly all the local societies are situated in larger districts than that of Herzele. If each of the 200 local societies did as much work as this one,[1] it would be an easy matter to insure the increased returns mentioned above.

This society has a section devoted to seeds which furnishes the members with improved varieties. This is a very important innovation, and would prove beneficial to Belgian agriculture at large if it were more extensively followed. Until recently improved grain was imported from other countries at a very high price. Such seeds were not, however, acclimated. Since Belgium is a country of small farming and hand labor it is unusually well fitted for raising improved varieties of seed for export instead of importing from other countries.

The by-laws governing the society provide that the section for the improvement and sale of seeds shall meet at least twice a year, namely, in January and in August. The purpose of these meetings is to consider the best plans for obtaining seeds and to audit the accounts. The section is under the direction of an agricultural engineer, who looks after the interests of the society. Each member is expected to try to improve at least one variety, working under instructions of the agricultural engineer and the director of the society.

In order to obtain seeds of the best quality, the following factors are taken into account: Method of fertilizing, preparation of soil, use of improved seeds, careful cultivation, proper maturity of seed, careful harvesting, etc. If any seeds are raised without following the prescribed regulations, they can not be sold as improved varieties. Any attempt to defraud is punished by expulsion from the society. If the seed raised by a member is accepted, he receives from the society the local market price and 1 per cent in addition for each of the points scored.

The secretary of the section attends to all the correspondence and keeps the accounts. The director and secretary receive 1 per cent of the net profits. A portion of the profits is kept as a reserve fund. The director has the power to suspend or expel members for violation of the rules.

Scientific methods are followed in the work. The members are well-trained, practical agriculturists, and by dividing the work it is possible to accomplish a great deal, though each member is responsible for only

[1] Cultures spéciales, expériences de Borsbeke-lez-Alost, 1890–'94, P. de Vuyst (E. S. R., 5, p. 232; 6, p. 890, 7, pp. 24, 579). Expériences sur les phosphates, 1894 et 1895, P. de Vuyst, Brussels (E. S. R., 8, p. 388).

a comparatively limited number of tests. It is only through coöperation that good results can be obtained. During the past few years the results have shown that the improvement of varieties has considerably increased the yield. The section possesses a good equipment. Its warehouses and experimental plats are situated near the new dairy at Borsbeke-lez-Alost. The buildings are lighted by electricity. There are suitable cellars for storing potatoes and buildings for storing seeds and grains. The section owns a potato sorter and grain sorters which are operated by steam. These improvements have been made at considerable cost, and it is not possible to supply the improved varieties of seed at the same price as seed of inferior quality. It is important that the producer sell direct to the consumer, since thus the profits of the middleman are saved.

The society of Herzele has organized several competitive exhibits. Awards have been given for improved agricultural machinery. The section for the improvement of cattle has for the past year devoted itself to the rational feeding of milch cows. It proposes to study the local feeding stuffs in order to ascertain their relative nutritive value. The section hopes to reduce the cost of rations per animal per day 20 centimes.

The society has also endeavored to improve methods of dairying. The Borsbeke-lez-Alost creamery is an interesting example of coöperation (see p. 20). Each patron is required to deposit 70 francs ($14) for each cow from which he furnishes milk to the dairy. He is not required to pay the whole sum at one time, but may arrange to have reserved ½ centime (0.1 cent) per liter (about 1.1 qt.) for the milk delivered. The labor and other expenses are covered by deducting from the price of the milk an additional ½ centime. Each member receives his skim milk. The profits from the sale of butter are divided among the members in proportion to the amount of cream furnished by each. The milk is tested with the Babcock apparatus. Most of the dairies in Belgium are conducted on a similar plan. In some of them the Gerber method of milk testing is used. The Borsbeke dairy has the following distinguishing peculiarities: Returning the skim milk to the shareholders, a method of cooling similar to that followed in America, and a system of disposing of the butter from house to house.

The present condition of the dairy is compared with that of previous years in the following table:

Statistics of the Borsbeke-lez-Alost coöperative diary.

Year.	Number of members.	Number of cows.	Total annual profit.	Annual profit per cow.
1892	47	80	$1,008	$12.60
1893	40	91	1,274	14.00
1894	40	95	1,862	19.60
1895	44	110	1,485	15.00
1896[1]	70	150	2,100	14.00

[1] Estimated.

It is the purpose of the Herzele local society to extend this dairy system throughout the whole district. If the annual profit per cow were only 60 francs ($12), it would mean 160,000 francs ($32,000) profit for the dairy due to the work of the society.

The Borsbeke dairy has an electric plant which furnishes electricity for lighting the public streets and houses and for power for small farms. It is also used for lighting the railroad station, churches, factories, etc. It is required that consumers subscribe for one share of stock for each 16-candlepower lamp desired. Since the consumers are shareholders as well, it is to their interest to conduct the business on the most economical principles. The extension of the coöperative plan outside the dairy has yielded returns sufficient to pay half the expenses of running the machinery of the dairy. This is, so far as known, the first instance of the application of the coöperative principle in municipal service. The example could be followed in other places and extended to include the water supply.

Plans are being made for a coöperative distillery. This will be located near the dairy, so that it can utilize the power from the dairy. The distillery will utilize the agricultural products and, at the same time, the distillery waste will be useful as a cattle food.

The members of the Herzele society have also organized a syndicate for breeding cattle, which is the first organization of its kind on a really scientific basis. Its by-laws provide that the cows be examined and classified by a permanent commission. The milk of each cow is examined every 3 months as to its quality and quantity. Premiums are given for the most improved cattle. In the sale of such cattle members are first given an opportunity of purchase. After each examination of the herds a placard showing the results is posted in the dairy for the information of the members. Owners of cattle learn to recognize the defects which they should avoid in cattle breeding. The points on which the cows are judged and their relative importance are as follows:

Scale of points in judging cows.

Character of the cow	100
General excellence	100
Milk yield	60
Butter yield of milk	60
Hygiene of the stable	40
Feeding	40
	400

Since the organization of this syndicate the cattle at Borsbeke have shown great improvement, the increased value of milk and butter amounting to about 5 francs per head annually. The local society intends to extend this work throughout the district.

Coöperative purchase of goods.—To obtain the greatest advantages in the coöperative purchase of goods it is necessary to purchase first-class material. For this a certain amount of credit is needed. It was for this reason that the local society organized a section for the purchase of fertilizing materials and feeding stuffs. It is also the intention to institute in each community a mutual credit and savings bank on the Raiffeisen system. There is already a bank of this kind at Borsbeke. The section for the purchase of goods has its own rules and regulations. The members are furnished with blanks to be filled out to show the kind of fertilizer or feeding stuffs which they wish to purchase. The officers of this section purchase at wholesale prices goods of guarantied composition. When the goods are received the members are at once notified and pay cash on delivery. There are few expenses for administration and little risk, and the farmers are thus enabled to secure their goods at wholesale prices plus 1 or 2 per cent necessary to pay the expense of printing the circulars, etc., and the cost of the analysis. The members purchased through this agency from 1890 to 1896 637,500 kg. (703 tons) of fertilizers, the annual purchase increasing from 64,000 kg. (75 tons) in 1890 to 163,500 kg. (190 tons) in 1896. From 1893 to 1896 the amount of feeding stuffs purchased was 121 tons, increasing from 14,000 kg. (17 tons) in 1893 to 48,800 kg. (54 tons) in 1896. It can be said that this section has already effected a net saving to the farmers of 22,527 francs ($4,500).

Insurance.—The Society of Herzele has taken steps toward the formation of a mutual fire insurance association. Different insurance companies were conferred with, and the company which has been selected has agreed to a reduction of 40 per cent on the usual premiums. The society has also organized a mutual cattle insurance company in seven of the fourteen villages in the province. The total number of cattle insured is 645. Each member of the insurance company pays a small premium on each cow insured. The members agree to buy a part of the carcass in case an insured cow should be killed. These companies indemnify for loss only in cases where the State is not liable. The Government encourages the formation of these mutual insurance societies by giving subsidies to the founders. The province of East Flanders aids them by a bank of reinsurance.

To further decrease losses the local society has a veterinary pharmacy so conducted that the farmers can readily obtain medicines. If it were not for this provision, animals might often die before a veterinary surgeon could be obtained.

Dissemination of information.—The Society of Herzele makes every effort to secure a wide dissemination of agricultural information. As has been stated, the society holds monthly meetings. Sometimes discussions are held on the same day in all the villages. This is especially the case at the season when fertilizers are applied. The farmers of the region and the members of the corps of instruction take part in these meetings. The attendance of farmers is encouraged by the distribution of agricultural books by lot. For the adult farmers the Government has instituted within each local society yearly courses in agriculture composed of fifteen lessons. In 1894 the local Society of Herzele organized a course in rural economy[1] for the younger members of the community. In all this work verbal instruction is supplemented by printed matter. Attractive placards are found exceedingly useful. The members receive each year a number of agricultural tracts, and a very complete agricultural library in charge of the secretary of the society is at their disposal. In 1895 a course of home instruction was arranged for the members of the society. The secretary sent the farmers lessons in pamphlet form requesting answers from them. In this work 1,190 pamphlets were sent out, and 600 answers were received. In addition to this the society organized among its members a reading course in practical agriculture.

The agricultural museum of the society contains a well-arranged collection, including specimens of fertilizers, feeding stuffs, and seeds, as well as diagrams showing the progress of affiliated societies. There is also a small laboratory. Making use of this equipment the society has classes for more technical instruction in agricultural science, different branches being studied by different groups of persons. The members of the classes receive journals and other books, and are encouraged in their ordinary work. Special annual premiums are awarded to those who, having completed their course, make the most useful suggestions for the improvement of the society.

Arbitration.—Difficulties are apt to arise between tenants and farmers. Recognizing this fact the Society of Herzele has organized a council of arbitration. The council endeavors in a friendly way to adjust difficulties which arise. It is composed of 2 landed proprietors, 2 tenants, an agricultural engineer, and 2 other persons. The first are elected by the landed proprietors of the society. They must be possessed of at least 6 hectares of land, three-fourths of which is rented and the remainder cultivated by themselves. The tenant members of the council are elected by the members of the local society and such other citizens as rent at least three-fourths of the land which they cultivate. Both the proprietors and the tenant members choose a supplementary member. The agricultural engineer, who must be neither a proprietor nor a tenant, is appointed by the board of directors of the local society. This arbitration council elects its own president and secretary. The members serve for a term of three years and may be reëlected. Meetings are held in April, June, and December. If necessary, special meetings may be called. In order to appeal to the council members of the society must first make a request to the secretary. The difficulties to be settled must relate to agricultural matters. The council examines into the points in dispute, and if there is sufficient ground hears the case from the interested parties separately or together. If it is deemed necessary, the council may request one of its members to

[1] M. Versnick, Grondbeginselen welke de pachteres niet missen kan, Brussels, 1896.

make a personal examination. The member chosen for this service must be assisted by a resident of the community in which the examination is to be made. The council, after examining the testimony, renders a decision, which is recorded. The secretary informs the interested parties of the decision and requests them to conform to it. The council publishes an annual report which includes the decisions the parties refused to accept. This report is distributed among the members of the local society. The council does not decide upon questions of taxes. Its real object is to settle difficulties whenever possible, and by its moral influence to remove abuses. The fear of publicity of adverse decisions prevents wrongdoing, and cases for arbitration rarely occur. The council has not had a case since 1895. The local society proposes to organize a similar council to settle difficulties arising between farmers and farm laborers.

The above description shows what may be accomplished by a local society which follows out the instructions of the Government. In every province it is the business of the state agriculturist to indicate the lines which should be pursued. The majority of the local societies neglect to consult these agriculturists; but the Government could easily remedy this by establishing closer relations between its agents and the secretaries of the local societies.

FEDERATION OF HORTICULTURAL SOCIETIES.

The federation of horticultural societies may be numbered among the official associations since it was established under Government auspices. Its object is to promote the progress of different branches of horticulture. The means employed comprise regular meetings of delegates from the societies, an official journal, and the organization of horticultural conventions and competitions. The Belgians as a nation have a special love for gardening. This is perhaps due to the sedentary habits of the people. Hothouses were established in the country toward the end of the sixteenth century. The collections of plants were large and varied. Contact with England and Holland increased the love of plants. The desire of the people to know the plants thoroughly led to the formation of horticultural societies and botanic gardens. The Botanic Garden of Ghent was founded in 1787. Those of Louvain, Antwerp, Liége, Mechlin, and Brussels are of more recent date. The last two are private institutions, though all are designed for educational purposes.

Belgium has a large number of forestry and botanical societies, and thirty-two of these, numbering about 12,000 members, belong to the federation. Each member pays an annual fee ranging from \$1 to \$4, and amounting in the aggregate to \$20,000. Three-fourths of this sum is used for publications and \$5,000 is distributed in prizes at exhibits. The original objects of the societies were to produce new varieties, improve existing methods of culture, and to devise new methods. The commercial side of the enterprise was, however, soon developed.

The expositions which began in 1846 were the chief means of disseminating information concerning plants discovered by explorers.

The publications[1] of the societies are numerous, and most of them are encouraged by the Government.

PRIVATE AGRICULTURAL SOCIETIES.

The private associations are of two classes, (1) those chiefly designed to improve the agricultural population materially and morally, and (2) those limited to some special purpose—for instance, the purchase of fertilizers, the establishment of coöperative dairies, the formation of apicultural societies, etc. They are chiefly local commercial enterprises.

The societies of the first class are of comparatively recent date. A variety of causes led to their formation, among others the farmers' need for assistance in the agricultural crisis, the inadequacy of the local agricultural societies, as ordinarily conducted, to oppose the spread of socialism, and the desire to protect the farming interests by lowering the ground rents, etc. The founders of these societies were actuated by religious, political, and economic motives. Such a society exists in almost every province. Detailed statements concerning some of them follow.

The province of West Flanders has a league of landed proprietors and farmers, established in 1885. Its members number 2,000. The chief benefits are free analyses, the economical purchase of fertilizers and seeds, a weekly journal,[2] insurance at reduced rates, and free legal consultation.

The Agricultural League (Ligue agricole) in East Flanders was established in 1891 to unite the local societies already in existence, to aid agricultural progress by the formation of coöperative societies in different parts of the province, to represent the interests of the members before the public authorities, and to furnish the members with advice and information. This league is well governed by a central governing body, assisted by delegates from all the affiliated societies. It has well-equipped quarters at Ghent, in which meetings, discussions, and exhibitions are held. Lecturers are also sent free to societies of farmers requesting them. The members receive a weekly journal[3] and an annual agricultural almanac containing much useful information. The

[1] Illustration horticole, Brussels. Lindemia, Iconographie des orchidées, Brussels. Revue de l'horticulture belge et étrangère, Ghent. Bulletin de la Société royale de botanique, Brussels. Bulletins d'arboriculture de floriculture, et de culture potagère, Ghent. Tydschrift over boomteelkunde, bloementeelt en moeshovenierderij, Ghent. (Flemish ed. of the preceding.) Journal des orchidées, Brussels. Moniteur horticole belge, Brussels.

[2] De West Flaamasche Landbouwer.

[3] De Landbouw, Ghent.

spread of the league has been remarkable. Within the short time since its foundation it has organized more than 200 local societies, among others societies for insurance of cattle. Only 2 of the 80 districts of Ghent lack such societies. The league of East Flanders has great influence with the public authorities.

The province of Brabant is the center of the Peasants' League (Ligue des paysans) which has branches in other provinces, especially Antwerp and Limbourg. The league originated in a very modest way at the first Catholic congress on social work. In 1886 M. Mellaerts, the present secretary of the league, organized an agricultural society at Goor (Heyst-op-den-Berg). In 1889, after more or less conference with other public-spirited men in Louvain, it was decided that the rules governing the society at Goor should be adopted by the league and that the effort should be made to create a branch of the organization in every parish. A federation of these societies forms the present league. A noteworthy feature of these organizations is their resemblance in certain details to the corporations or guilds of the Middle Ages. For instance, parochial societies have a patron saint and a feast day. The societies number more than 17,000 members. Each receives free a weekly journal.[1] The work of the league covers all branches connected with the progress of rural economy, but is principally concerned with the purchase of fertilizers and feeding stuffs. In 1895 the members purchased through the agency of the league 633.3 tons of fertilizers and 185.7 tons of feeding stuffs. In 1896 7,000,000 kg. of Thomas slag and 4,000,000 kg. of other fertilizers and supplies were purchased. In the season of 1896 6,000 tons of potatoes were sold for the members of the league in 6 weeks. There are at present 70 Raiffeisen banks connected with the league. The deposits in these banks amount to $100,000, and the premiums to $40,000. There are 100 mutual associations for the insurance of the stock of members, which charge 15 centimes per month for each $20 worth of stock insured.

In the provinces of Antwerp and Limbourg social agriculture has as yet no central organization. The Louvain Peasants' League at present seems to answer all purposes. The province of Limbourg has been aided by the diocese of Liége. It has a number of credit and savings banks and coöperative dairies. There are more dairy farmers in Limbourg than in any other province, the number being 100 in the town of Gheel alone. Insurance societies are common. The 44 coöperative dairies each handle on an average from 800 to 1,500 liters of milk daily. Each share of capital stock represents the milk of one cow.

In the province of Liége a central agricultural association has been organized, the society of Hainaut serving as a nucleus. The chief object of this association is commercial. Certain sections are devoted to the purchase of fertilizers, feeding stuffs, and agricultural implements, the sale of agricultural products, encouraging the growth of

[1] De boer and Le paysan, Louvain.

sugar beets, building sugar refineries, and providing accident insurance for the farmers. Half the parishes in the province have already joined the organization. Several of the societies have begun practical work. Seven or eight credit and savings banks and 15 cattle insurance companies have been established.

In the province of Hainaut the social side of agriculture has also been well started. The federation has a religious basis. It is called "Cooperation de Notre Dame des Champes (Society of our Lady of the Fields)." Its object is to improve the material welfare of the farmers, as well as their social and moral condition. It has sections for the economical purchase of goods, for bettering the financial standing of the association, and for cattle insurance. The business is done on the coöperative plan. In 1896 the section for the purchase of goods did business to the extent of more than a million francs ($200,000). In order that it may extend its influence to the inhabitants of the whole province, the federation is subdivided into branches for each district and parish. It is directed by an Episcopal committee, and each branch by a parochial committee. The attempt is made to interest public-spirited citizens to extend the membership, which is at present 2,400. The members receive a weekly journal[1] and an annual almanac.[2]

The province of Namur is without a central organization. The local societies, which were organized for the purchase of fertilizers, have, however, extended their work to other lines. One of these societies publishes a weekly paper for its members.

The province of Luxembourg has only lately become interested in work of this nature, but is making rapid progress. In general, its work is like that of the province of Hainaut. Through the efforts of the clergy some parochial organizations were established in 1894, beginning with coöperative dairies. A number of the villages possess hand separators and deliver only cream at the dairies. The Firton dairy has 43 separators, and produces 600 kg. of butter daily. Credit and savings banks are in operation in this province.

This review serves to give an idea of the great hold which these various agricultural organizations, owing their beginning to private individuals, have taken upon the people of Belgium. It will be observed that the social feature is the most prominent one in their organization and development. On the other hand, the local agricultural societies were established for the popularizing of scientific information. The local societies are directed by competent government officials, while the independent associations are directed by private individuals, who are public-spirited men well informed on matters of social reform. Though they have different objects, they are not antagonistic, but rather complementary. On economic questions, they meet on common ground. Both try to spread among the rural population organizations which procure material advantages.

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[1] La croix de syndicats, Bracquegines.

[2] Agenda des syndicats agricoles, Casterman.

OTHER ORGANIZATIONS.

Among other societies for the promotion of agricultural interests may be mentioned the more strictly scientific and economic organizations.

The Central Agricultural Society (la Société centrale d'agriculture) is a kind of agricultural academy. Its members comprise property holders and scientific men from all parts of the Kingdom. Monthly meetings are held in Brussels for consultation and discussion. The proceedings of the society are published in a journal.[1] The agricultural engineers, alumni of the Gembloux and Louvain technical schools, also have organizations which publish journals.[2] There is a national society organized for the improvement of draft horses, a national forestry association,[3] and several other organizations for special purposes.

Among the latter, the apicultural society of Hainaut deserves special mention. It was formed in June, 1890, with 19 sections and 650 members. At present it has 39 sections and numbers 2,000 members in Hainaut, Namur, and Brabant. The work has been developed by theoretical and practical conferences (about 200 a year); by lotteries for the distribution of books, implements, etc.; by the purchase of apicultural materials for members; by the establishment of honey depots, and by local and general expositions with competitive awards. It has published up to date a manual of apiculture, a work on floriculture, two pamphlets on the wintering of bees—one technical and the other popular, and a regular monthly bulletin.[4] The society exchanges publications with societies in Belgium and other countries. It has greatly increased apiculture in Belgium.

Among the economic societies may be mentioned the fertilizer syndicates. These are commercial enterprises and in some cases unite this feature with a coöperative plan. The most important of these syndicates is that of Landen, established in 1884, with a capital of 300,000 francs ($60,000). It has numerous branches and sells not only to its members, but to outsiders, the latter paying a higher price. It publishes a weekly paper.[5] Some of the shareholders are not purchasers, but invest capital for profit.

The Liége agricultural syndicate also publishes a journal,[6] and that of Campine-Herbaye publishes interesting annual reports.[7]

These syndicates differ from the coöperative societies previously mentioned. They are enterprises for selling goods at a profit, the profits being divided among the shareholders. The coöperative societies only attempt to provide their members with goods at the lowest possible

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[1] Journal de la Société centrale d'agriculture, Brussels.

[2] Revue agronomique de Louvain. L'Ingénieur agricole de Gembloux.

[3] Bulletin de la Société centrale forestiére, Brussels.

[4] Le progrès apicole, Charleroi.

[5] La cooperation agricole, Landen.

[6] Le syndicat agricole, Liége.

[7] Rapport du conseil d'administration du syndicat agricole Campine-Herbaye sur les opérations du syndicat, Hasselt.

cost. The syndicates have considerable influence on agriculture. They have lowered the price of fertilizers and, consequently, larger quantities have been used. Few syndicates have so far been organized for the sale of agricultural products.

The organization for the sale of seeds at Borsbeke has already been mentioned. At Verviers there is a similar enterprise for the sale of butter. Coöperative dairies (not under State control) are numerous. That of Oostcamp is the most important in the country. It handles 16,000 liters of milk daily and is unusually well equipped. It is the only dairy in the country with a refrigerating apparatus, and is patronized by over 300 farmers within a radius of 10 kilometers (6 miles). The dairy of Beernem is nearly equal to that of Oostcamp. It handles about 14,000 liters of milk daily and is operated with great satisfaction to the patrons. The latter have increased their herds and improved their methods of feeding. Yet, strange as it may seem, the introduction of coöperative dairies was opposed by the people.

A coöperative sugar factory was established two years ago at Anvaing, in Hainaut. The patrons of the institution are the shareholders. At Micheroux, in Liége, there is a coöperative milling association, and there is also one connected with the dairy at Oostcamp. A bill has recently been passed which permits the establishment of coöperative distilleries. These will furnish a market for the crops and the by-products may be utilized for cattle feeding.

The Belgian agricultural associations which have been described have benefited the farmer wherever they have been established. Some difficulties are encountered, but by perseverance and zeal on the part of the promoters these may be overcome and success attained. Each association is a school of instruction and in a short time becomes self-sustaining. Through the united efforts of these associations, the Belgian farmers have been assisted through the agricultural crisis, and they may confidently hope for a much better condition in the future.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

Analytical investigations of the hydrolysis of starch by acids, G. W. ROLFE and G. DEFREN (*Jour. Amer. Chem. Soc., 18* (*1896*), *No. 10, pp. 869–900, fig. 1, dgms. 7*).—The experiments of the authors were designed to determine whether there is any definite relation between the optical rotation and the reducing power of the products of the hydrolysis of starch, and whether the three products, maltose, dextrose, and dextrin, are influenced by definite laws. It was found that there is a constant relation between the rotatory and reducing power of the total product even when the starch is hydrolyzed under very variable conditions. Up to a rotation of about 90° this relation may be expressed by a curve corresponding to the equation: $x^2+y^2+468x-646y+1580=0$, where the abscissæ are the changing values of the rotatory power from amylodextrin (195°) to dextrose ($[\alpha]_{D386}=53.5°$), and the ordinates are the reducing power (K_{386}) when dextrose=100.

In connection with this the authors attempted to determine the constituents of commercial starch sugar by means of the Ventzke saccharimeter, for the purpose of control in the factory, and give a table for calculating the rotatory power of solutions of 7.5 to 10° Brix.

The hydrolysis of starch differs from that of sugar and salicin since starch is insoluble in water at the ordinary temperature and the amylodextrin formed by hot water is somewhat soluble in cold water and becomes more so as the temperature rises. Two reactions have to be considered, viz, the hydrolysis of dextrin to maltose and the hydrolysis of maltose to dextrose. If A is the dextrin content at the beginning and $A-x$ the amount remaining after the time t, and c the constant depending on the conditions of the hydrolysis we obtain—

$$\frac{dx}{dt}=c\,(A_o-x)$$

from which by integration—

$$\log\frac{A_o}{A-x}=ct, \text{ or } \frac{I}{t}\log\frac{A_o}{A_o-x}=c,$$

the general equation for the first phase of the reaction. The hydrolysis of the maltose to dextrose is peculiar, as it takes place simultaneously with the decomposition of the maltose. In the hydrolysis of the dextrin the maltose content rises rapidly to a maximum of 44.1 per cent with a rotation of 129 and then falls, while the dextrose increases steadily. The change in the maltose content can be expressed accurately only by a complicated equation, and the authors have therefore chosen an approximate formula, which is derived from the exact differential equation:

$$\frac{dD}{dt}=c_2M.$$

M represents the average maltose content during the period of observation. When M_1 and M_2 are the amounts of maltose during the times t_1 and t_2 and D_1 and D_2 the corresponding dextrose contents, c_2 the reaction constant we obtain:

$$D_2-D_1=c_2\frac{M_1+M_2}{2}(t_2-t_1)$$

or—

$$\left(\frac{1}{t_2-t_1}\right)\left(\frac{D_2-D_1}{\frac{M_1+M_2}{2}}\right)=c_2.$$

Experiments with hydrochloric acid, sulphuric acid, oxalic acid, and acetic acid, in varying concentration, showed that the constants are satisfactory and that, therefore, the reaction follows the law of reactions of the first class.—W. H. KRUG.

Constitution of the carbohydrates of the straw of cereals, C. F. CROSS and C. SMITH (*Chem. News, 74 (1896), p. 177*).—The furfuroids of the ripe straw have the formula $C_{10}H_{10}O_5$. With phenylhydrazin they give the osazones of pentoses, and on heating with hydrogen peroxid generate much carbonic acid. The authors conclude from this that they have the structural formula $C_5H_8O_3\langle{}^{O}_{O}\rangle CH_2$. The sugar obtained by hydrolysis with acid is partially fermented by yeast in neutral solution, when about 50 per cent of the furfuroid disappears. The stalks of the growing plant contain a different class of furfuroids. The osazones have a high melting point and are probably hexosazones. The furfuroids obtained by hydrolysis with acids are completely fermented by yeast and give no carbonic acid on heating with hydrogen peroxid. The amount of furfuroids present in the plant changes very little during its life, and the authors conclude from this that the furfuroids are the primary products of assimilation.—W. H. KRUG.

Investigations on phosphoric acid, M. BERTHELOT and G. ANDRÉ (*Compt. Rend. Acad. Sci. Paris, 123 (1896), pp. 773–782; 124 (1897), No. 6, pp. 261–269*).—The principal feature of the work here reported was the study of methods of distinguishing between the different forms of phosphoric acid. A colorimetric method for this purpose has been suggested by Sabatier,[1] but it fails to distinguish between orthophosphoric acid and pyrophosphoric acid. The method which the authors used for determining pyrophosphoric acid is based upon the same principle as that described in the American Pharmacopœia and is briefly as

[1] Ann. Chim. et Phys., ser. 6, 1889, p. 409.

follows: Precipitate in dilute solution with a mixture of magnesium chlorid, ammonium chlorid, and ammonium acetate, in the presence of a decided excess of acetic acid, keeping the whole for 3 or 4 hours in a boiling water bath. By this method practically the whole of the pyrophosphoric acid is precipitated, but the orthophosphoric acid, if present, remains in solution. The precipitate is washed, dissolved in nitric acid, and the phosphoric acid determined by precipitation with magnesia mixture in the usual way.

It was found that the precipitate obtained by this method from solutions of metaphosphoric acid were almost identical with that obtained from a solution of pure sodium pyrophosphate. The chemical character of the precipitate is discussed and investigations on the chemistry of the transformation of the different forms of phosphoric acid, especially pyrophosphoric acid and metaphosphoric acid, are reported.

The determination of potash, A. MERCIER (*Bul. Assoc. Belge, 10 (1897), pp. 403–405; abs. in Analyst, 22 (1897), No. 254, p. 138*).—The principal feature of this method is the substitution of mercurous chlorid for sodium formate in the reduction of the potassium-platinum chlorid. The method is as follows: Digest 5 or 10 gm. of the substance (according to its content of potash) for 1 hour in 500 cc. of cold water, and filter; evaporate 25 or 50 cc. of the filtrate to dryness on a water bath after the addition of 1 cc. of hydrochloric acid. Expel ammonium compounds from the residue by gentle ignition, take up in very dilute hydrochloric acid, and filter if necessary. Add 10 cc. of 10 per cent platinic cholorid solution, evaporate to a sirupy consistency on a water bath, cool, and extract with a mixture of 50 cc. of 80 per cent alcohol and 5 cc. of ether. Wash well on the filter with the alcohol ether and dissolve in boiling water. Bring the solution thus obtained to the boiling point, add mercurous chlorid little by little until a deposit forms on the bottom of the beaker (2 gm. are usually sufficient). Boil five minutes, allow the platinum to settle, then add 1 to 2 cc. of hydrochloric acid, and boil again. Filter; when cold wash the platinum thoroughly with boiling water, and ignite. The potash is estimated by multiplying the weight of platinum obtained by 0.4835. Results closely agreeing with the theoretical amounts were obtained by this method.

The carbohydrates of the tubers of Cyclamen europæum, B. RAYMAN (*Rozpravy české akademie, 1896, II, No. 30; abs. in Chem. Centr. Bl., 1897, I, No. 4, p. 230*).—Seventy per cent alcohol extracts cyclamose and cyclamin. Cyclamin is a glucosid and yields on hydrolysis cyclamiretin, $C_{14}H_{18}O_2$, fructose, and a dextrorotatory sugar which the author has called cyclose. Cyclamose is an amorphous white powder, slightly sweet and deliquescent. With HCl it gives levulose; the composition is $C_{36}H_{62}O_{31}$.—W. H. KRUG.

On the action of alkali solution on the phenylosazones of di- and polysaccharids, C. J. LINTNER (*Chem. Ztg., 20 (1896), p. 763*).—When hot saturated aqueous solutions of the osazones of maltose, galactose, and melibiose are boiled with alkali solution glyoxalosazone is formed and separates in small flocks. The same reaction was observed with the osazone of an achroodextrin. Glucosazone is not decomposed. The glyoxalosazone crystallizes in pale yellow shining leaflets or deep yellow needles.—W. H. KRUG.

The inversion of sugar solutions with sulphurous acid, K. STIEPEL (*Ztschr. Ver. Rübenz. Ind., 1896, p. 654*).—The numerous experiments show that the inversion of sugar solutions by sulphurous acid proceeds according to the Guldberg-Waage law.—W. H. KRUG.

Recent investigations on the decomposition of sugar under the influence of acids, and especially the production of carbonic acid, BERTHELOT and ANDRÉ (*Ann. Chim. et Phys., 1897, June, pp. 145–175*).

Researches on arabinose, BERTHELOT and ANDRÉ (*Ann. Chim. et Phys., 1897, June pp. 175–184*).

Allotropy of cane sugar, F. G. WIECHMANN (*Jour. Phys. Chem., 1 (1896), No. 2, pp. 69–71, fig. 1*).

Isomaltose, H. OST (*Chem. Ztg., 20 (1896), No. 79, pp. 761, 762*).—The author describes a simple method of preparing isomaltose.

The action of chloroform on starch, F. MUSSET (*Pharm. Centralhalle, 17 (1896), p. 587; abs. in Chem. Ztg., 20 (1896), No. 86, Repert., p. 249*).

Precipitation of carbohydrates by neutral salts, R. A. YOUNG (*Proc. Physiol. Soc., 1896–'97, pp. 16–18; abs. in Jour. Chem. Soc. [London], 1897, May, p. 235*).

The chemistry of perfumes, J. PASSY (*Rev. Scient., ser. 4, 7 (1897), No. 20, pp. 613–618*).

A new method of obtaining the perfumes of flowers, J. PASSY (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 14, pp. 783, 784; also Bul. Soc. Chim. Paris, 17–18 (1897), No. 10, pp. 519, 520*).

Rôle of tannin in plants and more especially in fruits, C. GERBER (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 20, pp. 1106–1109*).

A color reaction of gallic acid and tannin, E. HARNACK (*Arch. Pharm., 234 (1896), No. 7, p. 537*).

On the solubility of the red coloring matter of wine and on the sterilization of fruit musts, A. ROSENSTIEHL (*Bul. Soc. Chim. Paris, 17–18 (1897), No. 10, pp. 523–529*).

Observations on the decomposition of peroxid of hydrogen by silver oxid, BERTHELOT (*Ann. Chim. et Phys., 1897, June, pp. 217–232*).

On the alkaloids of lupine seeds, E. SCHMIDT (*Arch. Pharm., 235 (1897), pp. 192, 199, 218, 229; abs. in Chem. Ztg., 21 (1897), No. 39, Repert., p. 116*).

Contributions to the chemistry of animal fats, C. AMTHOR and I. ZINK (*Ztschr. analyt. Chem., 36 (1897), p. 1; abs. in Centr. Bl. agr. Chem., 26 (1897), No. 4, pp. 237–239*).—The author describes and gives the composition of several animal fats which are not well known.

The determination of starch in cereals, L. LINDET (*Bul. Soc. Chim. Paris, ser. 3, 15–16 (1896), p. 1163; abs. in Chem. Centbl., 1897, I, No. 4, p. 268*).—The author gives the following method: About 10 gm. of the ground cereal are digested at 40 to 50° C. for 12 to 14 hours with a solution which contains 1.5 per cent HCl and 2 per cent pepsin. The starch is then washed out on silk bolting cloth, a little mercuric chlorid added to the wash water to prevent fermentation, the starch collected on a tared filter, dried first at 50°, finally at 105°, and weighed.—W. H. KRUG.

Note on Wechsler's method for the separation of fatty acids, A. W. CROSSLEY (*Jour. Chem. Soc. [London], 1897, May, pp. 580–584*).

The determination of sugar in fermented worts and the unfermentable residue of the Saaz, Frohberg, and Logos yeasts, E. PRIOR (*Bayer Brau. Jour., 6 (1896), p. 373; Centr. Bl. Bakt. u. Par., 2. Abt., 2 (1896), p. 569; abs. in Chem. Ztg., 20 (1896), No. 94, Repert., p. 277*).

The determination of sugar in chocolate, X. ROCQUES (*Rev. Internat. Falsif., 9 (1896), p. 198; abs. in Chem. Centbl., 1897, I, No. 4, p. 268*).

On the determination of oxygen in the air and in water, D. A. KREIDER (*Ztschr. anorgan. Chem., 13 (1897), No. 6, p. 418; abs. in Chem. Ztg., 21 (1897), No. 17, Repert., p. 44*).

The determination of alkaline hydroxids and carbonates, G. LUNGE (*Ztschr. angew. Chem., 1897, No. 2, pp. 41, 42*).—The article is similar to that by Küster[1] and corroborates his results.

Determination of potash and phosphoric acid in fodders, H. W. WILEY (*Jour. Amer. Chem. Soc., 19 (1897), No. 4, pp. 320–322*).—A much more rapid method than the official method for analysis of ash. The article is concise and can not well be abstracted.—F. W. MORSE.

A method for the separation of aluminum from iron, F. A. GOOCH and F. S. HAVENS (*Ztschr. anorgan. Chem., 13 (1897), No. 6, pp. 435–440*).—The separation is effected by the insolubility of aluminum chlorid in a mixture of ether and concentrated hydrochloric acid saturated with hydrochloric-acid gas, while ferrous chlorid is readily soluble in such a solution. The details of the method are easily executed and the results satisfactory.—F. W. MORSE.

On the determination of citrate-soluble phosphoric acid in Thomas slag by means of free citric acid, M. PASSON (*Ztschr. angew. Chem., 1896, No. 22, pp. 677, 678*).—The author substitutes free citric acid for Wagner's solution. The most practicable strength of acid was found to be 2.8 per cent, used at the rate of 7 parts by weight of citric acid to 5 parts of slag, *i. e.*, 500 cc. solution to 10 gm. slag.—F. W. MORSE.

Automatic gas shut off upon breaking water connection, H. MICHAELIS (*Chem. Ztg., 21 (1897), No. 21, p. 194, fig. 1*).—The gas cock is operated by a lever which carries a funnel on one end and a counterpoise on the other of such weight as to balance the funnel when it is full of water. There is a constant flow of water from the water pipe through the funnel, when desired, the inflow and outflow being so adjusted as to keep the funnel full, and consequently the lever in a horizontal position, which leaves the gas connections open. When the water connections are broken, for any reason, the funnel empties itself and the counterpoise moves the lever, thus shutting off the gas.—J. T. ANDERSON.

Some apparatus for the technical analytical laboratory, E. S. JOHNSON (*Jour. Amer. Chem. Soc., 19 (1897), No. 4, pp. 281–290, figs. 6*).—Although devised for an iron and steel laboratory, part of the apparatus, especially those forms for the rapid measurement of reagents and for continuous filtration of large volumes of solution, would be equally advantageous in an experiment station laboratory.—F. W. MORSE.

A new extraction apparatus, T. GÜNTHER (*Chem. Ztg., 21 (1897), No. 19, pp. 169, 170, figs. 2*).—This is more properly a new stand or support for an extraction set or battery. The extraction flasks, arranged in a row over gas burners, rest on asbestos plates or pieces of wire gauze, which are independently adjustable in the frame. The wooden supports for the condensers are divided longitudinally into halves clamped together for convenience of adjustment to the condensers. These supports may be clamped to the uprights at any desired height, and hence may be used with extraction flasks of any size.—J. T. ANDERSON.

Rules and tariff for agricultural chemical examinations at the chemical control station in Christiania, Norway (*Tidsskr. norske Landbr., 4 (1897), pp. 132–134*).

BOTANY.

The evolution of heat by wounded plants, H. M. RICHARDS (*Ann. Bot., 11 (1897), No. 41, pp. 29–63*).—The author conducted an extended series of experiments with potatoes, kohl-rabi, carrots, onions, cucumbers, radishes, and the leaves of Diervilla and Liriodendron, the

[1] Ztschr. anorgan. Chem., 13 (1897), No. 1, p. 127.

object of the investigation being to establish the fact of a rise in temperature, if any followed wounding of the plant tissues; and in the second place to determine the curve of the change of temperature. The principal apparatus used in this experiment was the thermoelectric element in connection with a mirror galvanometer. The apparatus and details of the experiment are fully described.

Numerous precautions were found necessary to avoid error, and care was taken to eliminate as far as possible all sources of error. All the plants were kept in a saturated atmosphere to prevent wilting and also to avoid changes of temperature due to evaporation.

As a control for the thermo-electric method, experiments were also carried on with a simple form of calorimeter by which the temperature curve of most of the plants could be determined. The results secured with this apparatus were of a confirmatory nature.

Most of the author's experiments were conducted with potatoes, and it was found that there was no difference in temperature between the cut surfaces and the uninjured potato immediately after injury; but about two hours after wounding there was an indication of a rise in temperature, which steadily increased until the maximum was reached in the injured plant.

An important source of error which must be guarded against in such experiments is the use of unhealthy potatoes, it having been found that a very small rotten spot which had no influence on the general temperature of the tuber would, under the conditions of the experiment, affect the temperature very sensibly. The greatest difference between injured and uninjured potatoes found was 0.4° C. It was also found that old potatoes showed a greater difference between living and dead tissue than the new ones only recently taken from the ground. This is readily explained by the fact that the old potatoes are just emerging from their resting period, while the new ones are entering a period of quiescence, when the metabolic processes are very low.

It was shown that the influence of the wounding in the case of the potato extends to a very little distance from the point of irritation. The generalization just given applies equally well to the radishes, the kohl-rabi, the cucumber, and the carrot, but for onion bulbs the effect of injury was more widely distributed.

The experiments with leaves, which were made in a bell glass calorimeter, showed that the maximum increased temperature was reached much more readily than in the experiments with fleshy objects. In four and one-half hours after injury the leaves of Liriodendron were 0.75° C. warmer than the uninjured ones. On the next day there was but little difference in temperature, shortly after which time the injured leaves died.

From these experiments it would appear that plants, like animals, respond to the stimulus of injury by an attempt to rally from it, and the rallying is accompanied by somewhat the same symptoms. The reaction in the case of plants is not absolutely as marked as with the higher animals, but when comparisons are made between the ordinary temperature of plants and the surrounding medium the rise in temperature after injury is as great, if not greater, than in the case of animals.

Summarizing the results of his experiments, the author states that (1) there is a certain rise in temperature of the adjacent tissue following the wounding of plants; (2) this reaction runs a definite course, attaining its maximum some twenty-four hours after injury; (3) the maximum rise in temperature due to injury of all the plants investigated was between two and three times the difference in temperature between the living and dead tissue of the same plants; (4) in potatoes and similar massive tissues the effect is local, while in onion bulbs a much greater extent of tissue is affected.

Assimilatory inhibition of plants, A. J. EWART (*Jour. Linn. Soc. Bot.*, *31* (*1897*), *No. 219*, *pp. 554–576*).—In continuation of his previous work upon this subject,[1] the author gives the effects of continued absence of light and carbon dioxid upon assimilation, both these agencies being omitted from the previous paper.

After describing and commenting at length upon the numerous experiments conducted, the author gives the following conclusions:

"Chloroplastids developed in darkness, whether they become green or are etiolated, may possess a fairly active power of assimilation corresponding to their size and depth of coloration. The power of assimilation is absent while the etiolated leaf is still quite young, and finally disappears again after the leaf has been kept for a long time in darkness, even though abundant supplies of food material may be present. Etiolated leaves exposed to light in an atmosphere deprived of all carbon dioxid turn green and may acquire a quite active power of assimilation, which, however, soon begins to weaken and is in most cases rapidly lost. The stoppage of assimilation may take place while the chloroplastids are still normal in appearance; but in all cases a visible change in appearance and coloration is finally produced. From the first condition recovery is generally, but from the second only rarely, possible. Assimilatory cells or tissues, therefore, which are prevented from assimilating by being kept in darkness, or by being exposed to light in an atmosphere deprived of all carbon dioxid, retain their potential power of assimilation only for a given length of time, which is, the other conditions being similar, shorter in the latter case than in the former, and which is in each case mainly dependent upon the hereditary nature of the given plant."

New species of fungi, J. B. ELLIS and B. M. EVERHART (*Amer. Nat.*, *31* (*1897*), *No. 365*, *pp. 426–430*).—Notes and descriptions are given of 20 species of fungi from various localities.

New West Indian fungi, J. B. ELLIS and F. D. KELSEY (*Torrey Bul.*, *24* (*1897*), *No. 4*, *pp. 207–209*).

Concerning the present systematic classification of fungi, G. LINDAU (*Bot. Centr. Bl.*, *70* (*1897*), *No. 1*, *pp. 2–12*).

Numerical variation of parts in Ranunculus repens, J. H. PLEDGE (*Nat. Sci.*, *10* (*1897*), *No. 63*, *pp. 323–328*, *figs. 4*).

How flowers attract insects, F. PLATEAU (*Bul. Acad. Roy. Sci. Belg.*, *ser. 3*, *33* (*1897*), *No. 1*, *pp. 17–41*; *abs. in Bot. Ztg.*, *55* (*1897*), *No. 7*, *pp. 108–109*).

An ecological study of the genus Talinum with descriptions of two species, J. W. HARSHBERGER (*Torrey Bul.*, *24* (*1897*), *No. 4*, *pp. 178–188*, *pl. 1*).

[1] Jour. Linn. Soc. Bot., 30 (1896), No. 217, p. 364 (E. S. R., 8, p. 287).

Botanical examinations of peat samples (*Tidsskr. norske Landbr., 4 (1897), pp. 114–118*).

The physiological importance of phosphoric acid in the organism of the sugar beet, J. Stoklasa (*Neue Ztschr. Rübenz. Ind., 38 (1897), No. 15, pp. 168–177*).

Study on chlorophyll, J. Stoklasa (*Bul. Soc. Chim. Paris, 17–18 (1897), No. 10, pp. 520–523*).

Recent investigations relating to root tubercles of leguminous plants, C. Naudin (*Jour. Agr. Prat., 61 (1897), I, No. 14, pp. 491–495*).—A résumé of the more important recent literature.

Concerning the grafting of Helianthus annuus and H. lætiflorus, L. Daniel (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 16, pp. 866–869*).

Concerning agar-agar cultures of algæ and amœba, N. Tischutkin (*Centr. Bl. Bakt. u. Par., 2. Abt., 2 (1897), No. 7–8, pp. 183–188*).

Concerning the nutrition of Cladochytrium pulposum, P. Vuillemin (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 17, pp. 905–907*).

A new method for the study of the emission of liquids by plants, M. Cornu (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 13, pp. 666–669*).

The olegodynamic phenomena of plant and animal cells, O. Israel and T. Klingmann (*Arch. Path. Anat. u. Physiol., 147 (1897), p. 2; abs. in Chem. Ztg., 21 (1897), No. 29, Repert., p. 81*).

The assimilatory energy of blue and violate rays of the spectrum, F. G. Kohl (*Ber. deut. bot. Gesell., 15 (1897), p. 111; abs. in Chem. Ztg., 21 (1897), No. 39, Repert., p. 117*).

Cross fertilization, L. Coates (*California Fruit Grower, 20 (1897), No. 18, p. 6*).—A popular paper embodying the results of experiments previously reported.

METEOROLOGY.

Annual summary of meteorological observations in the United States, 1896 (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 24 (1896), No. 13, pp. 487–496, charts 5*).—This number of the Review is devoted to an annual summary of observations on atmospheric pressure, temperature, precipitation, wind movement, cloudiness, and other meteorological phenomena "based upon data received from about 3,000 stations occupied by regular and voluntary observers of the Weather Bureau, Canadian data received by the coöperation of Prof. R. F. Stupart, and Mexican data received by the coöperation of Dr. M. Bárcena, the director of the central meteorological observatory of Mexico." The data are given in tables and charts and summarized in the text.

"The lowest annual averages within the United States were: Williston, 37.6; Moorhead, 37.7; Bismarck, 38.9; Sault Ste. Marie, 39.5; Duluth, 39.6; Havre, 39.7. For Canada: Prince Albert, 30.5; Battleford, 31.1; White River, 31.2; Minnedosa, 31.6. The highest averages were: Key West, 76.4; Jupiter, 73.4; Yuma, 73.1; Tampa, 71.4; for Canada, Halifax, 43.2; Charlottetown, 43.1; Yarmouth, 43.

"The mean annual temperature was above the normal at nearly all stations. The largest departures were in the middle slope and the west Gulf States. The annual temperatures were below normal in the Florida Peninsula and on the north Pacific Coast and in portions of New England. . . .

"In general maximum temperatures exceeding 105 occurred as follows: Yuma, 117; Phœnix, 115; Fresno, 111; Red Bluff, 109; Fort Smith, 107; Shreveport and Wichita, 106. The absolute maximum for the whole country was 117 at Yuma. Minimum temperatures of —25 or more occurred at Havre, —33; Lander, —31; Northfield, —30; Moorhead, —28; Williston and Idaho Falls, —26; Sault Ste. Marie, Duluth, Miles City, —25.

"The regions of large annual ranges of temperature were as usual the north, middle, and south Pacific slopes and the Missouri Valley. The stations of small annual range were: Hatteras, 76; Key West, 38; Tatoosh Island, 48; Eureka, 45; Point Reyes Light, 51.

"The accumulated departures of average monthly temperatures from the normal values show that there was a steady diminution in the deficit with which the year began in the Atlantic and Gulf States, generally turning into a surplus before the end of the year. In other sections of the country the year began with an excess of temperature which generally increased steadily until the close. The greatest deficit for the year was: —0.77, Florida Peninsula. The greatest excesses for the year were: The middle slope, +2.07; Abilene, +2.19. . . .

"The greatest precipitation was: Tatoosh Island, 100.8; Astoria, 94.8; Fort Canby, 78.6; East Clallam, 78.1. The least was: Yuma, 2.6; San Diego, 8.7; El Paso, 9.3; Pueblo, 10.8.

"An annual rainfall above 60 inches occurred on small portions of the coast of Florida and Alabama, Nova Scotia, and Newfoundland, as also along the entire coast of Oregon and Washington. An annual rainfall of less than 10 inches occurred in southern California, Nevada, Utah, and Colorado, western New Mexico, and northern Arizona.

"The accumulated departures of total monthly precipitation from the normal values show that a steadily increasing deficit has prevailed over the Atlantic States, Ohio Valley, and lake region; but elsewhere a slight excess has accumulated. The large total annual deficits were the west Gulf States, 12.50; South Atlantic States, 10.70. The largest accumulated excess was north Pacific, 10.10. . . .

"The greatest frequencies [of thunder storms] per station per year were: Florida, 27.9; North Carolina, 25.3; Missouri, 22.9; Tennessee, 20.5. The smallest frequencies were: California, 3.3; Montana, 5.0; Oregon, 2.7; Washington, 2.2."

Monthly Weather Review (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 25 (1897), Nos. 1, pp. 1–42, charts 7; 2, pp. 43–84, charts 7; 3, pp. 85–121, charts 6*).—Besides the usual meteorological summaries, No. 1 contains special articles on cloud observations and measurements at the Blue Hill Meteorological Observatory, Milton, Massachusetts, by A. L. Rotch; excessive precipitation in the United States, by A. J. Henry; memorable snowstorms in South Dakota, by S. W. Glenn; and international cloud observations at Atlanta, by F. L. Blake; and notes by the editor on an early history of the thermometer and barometer, Mexican climatological data, meteorology in the public schools, and the value of the meter and yard.

No. 2 contains a special contribution on wind nomenclature, by F. W. Proctor, and the following notes by the editor: Suggestions to observers, fall of an aerolite in Arizona, cycles in meteorology, the development of the kite by European scientists, Mexican climatological data, chemical composition of the upper air, meteorological notes by Capt. William Scoresby, jr., and opening of navigation in Canada.

No. 3 contains notes by the editor on ice in Kennebec River; fire at Huron, South Dakota; the stereoscopic study of clouds; Mexican climatological data; a monument to Buys-Ballot; and suggestions to observers.

On the causes of injury from frosts, F. F. BRUIJNING and A. MAYER (*Forsch. Geb. agr. Phys., 19 (1896), No. 4–5, pp. 485–494, pl. 1*).—Three conditions affecting the lowering of the freezing point in plants were studied, namely, the capillary structure of the vessels carrying the plant sap, the effect of dissolved matter, and the influence of undercooling (*Unterkühlung*).[1] In the first the freezing point of the juice of yew leaves and various artificial solutions was tested in capillary tubes varying in size from 8 to 64.2 square decimillimeters. In case of the yew sap the average lowering of the freezing point due to capillarity was 5.3° C. The average lowering of the freezing point due to dissolved matter was 1.3°, while that due to undercooling was 2.2°.

Meteorology at Alnarp, Sweden, 1894–'96, M. WEIBULL (*Tidskr. Landtmän, 17 (1896), pp. 867–870, 892–894*).

The weather in Denmark, 1895–'96, V. W. JANTZEN (*Tidsskr. Landökon, 16 (1897), pp. 121–140*).

Phenological observations, 1894, E. IHNE (*Ber. Oberhess. Ges. Nat. u. Heilk., 1896, Aug., pp. 76–94*).

Recent phenological literature, E. IHNE (*Ber. Oberhess. Ges. Nat. u. Heilk., 1896, Aug., pp. 95–99*).—Continued from page 14 of the thirtieth report of this society.

Phenological observations, 1895, and other contributions to phenology, E. IHNE (*Ber. Oberhess. Ges. Nat. u. Heilk., 1896, Aug., pp. 119–150*).—This includes, besides observations according to the Hoffman-Ihne plan, notes on recent phenological literature and suggestions regarding phenological observations.

Results of rain, river, and evaporation observations made in New South Wales during 1895, H. C. RUSSELL (*Dept. Pub. Instr. Sidney, 1896, pp. 199, dgms. 4, map 1*).

SOILS.

The soils of the Hagerstown valley, C. W. DORSEY (*Maryland Sta. Bul. 44, pp. 189–209*).—The progress made in the classification and study of the soils of Maryland[2] is explained and mechanical analyses are given of soils and subsoils of 7 typical corn lands, 8 wheat lands, and 6 grass lands of the limestone area of this region, 5 samples of subsoil on the Hudson River shales, and 4 from the peach lands on Cambrian sandstone.

"(1) As the soils of the State have been classified into a number of distinct types differing in origin and agricultural value, there is need of detailed study upon each of these types to determine the local variations which were not considered in the general classification.

"(2) In the Hagerstown valley there are 3 principal rock formations which give rise to 5 distinct soil types, all differing in their relations to agriculture.

"(3) The Cambrian sandstone soils derived from the decay of the whitish Cambrian sandstone are shallow, stony soils which occupy a narrow strip along the base of the Blue Ridge Mountains. These soils are the center of the mountain peach industry which has of late years come into considerable prominence.

"(4) The Hudson River shales upon decomposition give rise to a light yellow soil which, though shallow and easily washed away, is remarkably fertile when the

[1] Cooling below the freezing point without solidification by keeping the solution perfectly quiet and not introducing any foreign body to set up crystallization.

[2] See also Maryland Sta. Bul. 21 (E. S. R., 5, p. 162).

depth of the soil is taken into consideration. These soils in good seasons, with careful treatment, produce fair yields of wheat, corn, and grass, and the cultivation of peaches and other fruits is profitably carried on.

"(5) The Trenton limestone gives rise to the finest type of heavy clay soils, which consist of the insoluble residue after the lime carbonate has been removed in solution by the percolating rains. These soils, on account of the favorable conditions they maintain for the growing crops, are well suited to general agricultural purposes. They may, since their texture and relation to the various crops vary so materially, be classified into corn, wheat, and grass lands.

"(6) The corn lands in the limestone area are the lightest in texture and on account of their loose, mellow condition are especially adapted to the cultivation of corn. Too loose and sandy for the heaviest yields of wheat, they do not retain sufficient moisture for a heavy growth of grass, although both of these crops are raised.

"(7) The wheat lands present a type of soil which has a heavier top soil, while the stiff clay is not so far from the surface as it is in the corn lands. The soils are well drained and contain a considerable amount of fragments of disintegrated rock. They produce the finest quality of bright, heavy wheat, and a little more grass than the light, loamy corn soils, but the production of corn is much less.

"(8) The grass lands occupy the lower levels where the finest soil particles have accumulated which have been washed down from the surrounding slopes. These soils are stiff, heavy clay, which always retain sufficient moisture for a heavy growth of grass. They are too stiff for corn, and wheat is apt to run to straw, besides there is a tendency to disease on such moist lands."

The determination of free humus acids in moor soils, B. TACKE (*Chem. Ztg., 21 (1897), No. 20, pp. 174, 175, figs. 1*).—The acid reaction of certain moor soils is attributable mainly to their humus acids or acid humates. The proposed method is based on the fact that these acid substances decompose neutral carbonates with the evolution of carbon dioxid. As the oxygen of the air tends to decompose these substances, forming carbon dioxid, the ordinary atmosphere must be replaced by one of hydrogen or some other inert substance during the course of the experiment. The apparatus used by the author consists essentially of a hydrogen generator with wash bottles, a decomposition flask, and an absorption tube. The soil made into a paste with 100 to 200 cc. of water, is put into the decomposition flask, which is then connected with the empty absorption tube on the one hand and with the hydrogen generator on the other, and a current of hydrogen passed through for an hour to expel both oxygen and carbon dioxid from the apparatus. Then without interrupting the flow of hydrogen, 100 cc. of a fifth or tenth normal solution of sodium hydroxid is introduced into the absorption tube, and an excess of calcium carbonate in the condition of paste, into the flask with the soil. The current of hydrogen is allowed to pass for three hours, when the contents of the absorption tubes are washed into a suitable vessel and its alkalinity determined by Winkler's method, by adding barium chlorid and then titrating with fifth or tenth normal hydrochloric acid, using phenolthalein as an indicator. The amount of carbon dioxid liberated by the acids of the soil is thus determined.—J. T. ANDERSON.

Some notes concerning the nitrogen content of soils and humus, E. FULMER (*Washington Sta. Bul. 23, pp. 19*).—Investigations relating to the importance of humus in the soil are briefly reviewed, and analyses showing humus, total nitrogen, nitrogen in humus, total phosphoric acid, phosphoric acid in humus, potash, lime, iron oxid, and organic matter are reported for 53 samples of soil from the following counties: Spokane, Jefferson, San Juan, Okanogan, Whitman, Whatcom, Kitsap, Skagit, Yakima, King, Thurston, Snohomish, Island, Clallam, Clarke, and Pierce.

"Hilgard's conclusion that any soil in which the humus contains less than 2.5 per cent of nitrogen is to be suspected of 'nitrogen hungriness' seems to be fully verified by [the author's] results.

"The very great difference found by Hilgard and Jaffa between the percentages of humic nitrogen in arid soils, and in soils of humid regions, is not fully confirmed by this work, although the samples of arid soils tested were too few to warrant any conclusion."

The attempt is made to trace the relationship between the total nitrogen and the nitrogen in the humus, but a comparison of actual determinations of nitrogen with the calculated amounts does not show very concordant results.

On the improvement of retentive clays: Drainage of the so-called "hardpan" lands of southern Illinois, E. DAVENPORT (*Illinois Sta. Bul. 46, pp. 357–362*).—It is claimed that the soil of southern and southwestern Illinois is largely the resultant of the action of two great glaciers, the first of which left a deposit of "impalpable clay and sand through which water makes its way so slowly that it is classed as an impervious soil;" the second "in its descent covered deeply with a mixture of bowlder clay, sand, and gravel the older and thinner deposit . . . left by the first glacier." The heavy and retentive subsoil is known in this region as hardpan, and when it comes to the surface it constitutes a "scald" or "stick spot." Notwithstanding their unfavorable physical condition, these soils are very fertile.

Mechanical analyses of 2 samples of these soils and of 1 sample from the station for comparative purposes are given in the following table:

Mechanical analyses of ignited soil.

Name of particles.	Size of particles.	Odin soil.		Edgewood soil.		Station soil.	
		Surface.	Subsoil 20 in.	Surface.	Subsoil 15 in.	Surface.	Subsoil 15 in.
	Mm.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Gravel	More than 2	....	....	0.19	....	1.02	1.06
Grits	2 — 0.5	1.03	0.44	1.64	0.72	6.01	6.85
Coarse sand	0.5 — .2	3.78	1.52	7.66	2.31	23.69	28.71
Fine sand	.200— .060	8.38	3.98	7.64	3.72	9.48	9.94
Coarse silt	.060— .025	45.01	32.61	45.14	30.40	27.35	23.31
Fine silt	.025— .010	19.01	16.48	16.05	12.02	9.75	8.31
Dust	.010— .002	11.44	10.08	9.22	10.01	7.96	7.36
Clay	Less than .002	10.78	34.44	12.08	39.77	14.57	14.46
		99.43	99.55	99.62	98.95	99.83	100.00
Organic matter[1]		6.53	6.07	4.12	6.87	7.40	4.90

[1] Organic matter equals loss on ignition of water-free soil.

These analyses show the predominance of very fine soil particles, especially in the subsoil, and explain the retentive power of the soils for water. In order to improve their physical condition it was decided to resort to a test of drainage. For this purpose one of the most refractory spots procurable was selected at Edgewood and 3½-inch tile were laid 2½ ft. deep in lines 50 ft. apart. A record is given of the rainfall and the flow from the drains from the time the work was finished, March 3, to July 19, 1896. The rainfall was promptly carried off by the drains and the physical condition of the soil was improved.

"Equal areas of tiled and of undrained land yielded corn and stover as follows: Undrained, 2,215 lbs. of ears and 1,570 lbs. of stover; tiled, 2,711 lbs. of ears and 1,990 lbs. of stover. This is 22 per cent increase of corn and 26 per cent increase of stover on the tiled portion. . . .

"It yet remains to learn if drains will endure, but the closest observation has failed to find signs of destruction. But little silt appears at the outlet and none has settled in the tile along the course of the drain. . . .

"The experience of the year indicates that 50 ft. or even 100 ft. apart is unnecessarily close for lines of tile even in these so-called impervious soils."

The relation between the underground and the cultivated soil, A. HELLAND (*Tidsskr. norske Landbr., 4 (1897), pp. 145–161*).

On the industrial utilization of peat marshes in Sweden, Denmark, Northern Germany, and Holland, A. DAL (*Tidsskr. norske Landbr., 4 (1897), pp. 76–91*).

FERTILIZERS.

Experiments with urine and liquid manure, 1889–'95, N. A. HANSEN (*Tidsskr. Landökon, 15 (1896), pp. 576–593*).—The experiments here reported were conducted at Dalum Agricultural School, Denmark, and were a continuation of those noted in E. S. R., 5, pp. 523–525. The results obtained corroborated in general the conclusions drawn from the earlier work. The greatest losses of liquid manure and of nitrogen in storage were found to occur during the summer months, viz, 1 and 2 per cent for liquid manure and nitrogen, respectively, against 0.2 and 1.5 per cent during the spring and early summer months, and 0.2 and 1.2 per cent during fall and winter. The best time for applying liquid manure was found to be during April on grass land, and April and July on roots. Taking the yield of hay on plats fertilized with liquid manure during April at 100, the yields from similar plats fertilized during other months were as follows: September, 47; October, 43; November, 67; January, 66; March, 81; May, 77; July, 42; August, 23. For roots (also taking the yield when manured in April as 100) the figures were, May, 86; June, 90; July, 106; August, 74 (average, 1889–'95).

Liquid manure applied between the rows in root fields in every trial produced better results than were obtained from the same quantities spread over the whole field. The yields by the former method of application during the different months being placed at 100, those obtained by the latter method were, when applied in June, 86; July, 78, and August, 28.

Swine urine, yield and composition.—The urine of 30 pigs was saved during 3 consecutive days in March and July, 1895. The main results of weighings and partial analyses are given in the following table:

Yield and composition of swine urine.

Dates of observation.	Average data for pigs.		Amount of urine during 3 days.	Nitrogen in urine.	Calculated yields per year.	
	Age.	Weight per head.			Urine.	Nitrogen.
	Months.	*Pounds.*	*Pounds.*	*Per cent.*	*Pounds.*	*Pounds.*
March 6-8	7	145	357.5	0.360	1,450	5.21
July 29-31	8	228	1,339.3	.210	5,432	11.41
Averages	7½	187	848.4	.242	3,441	8.31

The average specific gravity of the urine was 1.017; the urine collected during March contained 0.360 per cent of nitrogen, 0.077 per cent of phosphoric acid, and 0.256 per cent of potash. Only nitrogen determinations were made in the samples collected during the summer months.—F. W. WOLL.

Are the chemical substances used in sterilizing human excrement injurious to agricultural plants and to the beneficial organisms of the soil? H. PETERMAN (*Jour. Agr. Prat., 61 (1897), I, Nos. 15, pp. 521–525, fig. 1; 16, pp. 558–561, fig. 1*).—A detailed account is given of the results of experiments which show that mixtures of solid and liquid human excrement were completely sterilized by treatment with sulphuric acid, phosphoric acid, aqueous extract of superphosphate, copper sulphate, zinc sulphate, zinc chlorid, and lysol at rates of from 1 to 1½ per cent. When such sterilized manure was used at the rate of from 9 to 11 tons per acre, the germination of flax, colza, oats, wheat, corn, beets, and clover was not interfered with and neither the quantity nor quality of the potatoes and corn was injuriously affected. The treated manure did not arrest the action of the nitrifying organisms nor those living in symbiosis in the tubercles of the lupine. The amount of nitric nitrogen produced in soils treated with the sterilized manure was as large as that to which unsterilized manure was applied and lupines grown in the different soils were abundantly supplied with root tubercles. In the author's opinion, the four most economical preservatives are copper sulphate, zinc sulphate, zinc chlorid, and phosphoric acid. Of these phosphoric acid seems preferable on account of its effectiveness combined with its cheapness.

Commercial fertilizers, H. A. HUSTON (*Purdue University Special Bul., May, 1897, pp. 8*).—Analyses and valuations of 350 samples of fertilizing materials are reported, accompanied by notes on the extent of the fertilizer trade in Indiana, quality of the fertilizers sold, and on valuation.

"The estimated sales of commercial fertilizers in Indiana during 1896 amounted to 42,000 tons. This is an apparent decrease of 3,000 tons from the estimated sales in 1895. The decrease is, I believe, only apparent, for it now seems probable that the estimate for 1895 was too high, owing to a considerable number of tags being carried over which were really used in 1896, although they appear in the 1895 sales. It is probable that an estimate of 42,000 tons in 1895 and 45,000 tons in 1896 would more nearly express the real facts. . . .

"The amount of plant food in the fertilizers sold in 1896 includes 5,643 tons of actual phosphoric acid, of which 3,171 tons were in the form of 'available' in acidulated goods, 1,143 in the form of 'insoluble' in acidulated goods, and 2,320 tons were in bone and non-acidulated packing-house products. . . .

"The amount of nitrogen contained in the fertilizers sold in 1896 was 884 tons, equivalent to 1,073 tons of ammonia. Nearly all of this was derived from packing-house products, although a few of the samples contained nitrate of soda and tobacco stems and garbage products.

"The amount of actual potash contained in the fertilizers sold was 562 tons."

Functions, composition, and valuation of manure (*Jour. Bureau Agr. Adelaide, Australia, 9 (1897), No. 8, p. 271*).

Fertility imparted by manuring and derived from atmospheric sources, F. C. SOLOMON (*Agl. Gaz. [London], 45 (1897), No. 1216, p. 371*).

The fermentation and conservation of barnyard manure, H. JOULIE (*Ann. Sci. Agron., 1897, I, No. 2, pp. 193–249*).

Investigations on the best methods of handling barnyard manure (*Mitt. deut. landw. Gesell., 12 (1897), No. 12, p. 57; abs. in Chem. Ztg., 21 (1897), No. 33, Repert., p. 94*).

Barnyard manure and commercial fertilizers, B. FALLOT (*Prog. Agr. et Vit., 27 (1897), No. 14, pp. 415–419*).

Bone meal adulterated with sand, A. ATTERBERG (*Tidskr. Landtmän, 17 (1896), pp. 665, 666*).

Thomas slag, L. GRANDEAU (*Ann. Sci. Agron., 1897, I, No. 1, pp. 1–157, figs. 2*).—The results of investigations by the author and others, especially Wagner, Maercker, and Hoyerman, and of practical experience in the use of Thomas slag, are summarized, and the production, composition, and use of slag under different conditions of soil, crop, etc., are discussed. The conclusions are reached that the citrate solubility determined according to Wagner is by no means a criterion of the fertilizing value of phosphates, and that slag should be bought on guaranty of total phosphoric acid and of fine meal. The latter should amount to 75 to 80 per cent.

The use of superphosphates and potash salts during the summer, MAIZIÈRES (*L'Engrais, 12 (1897), No. 24, pp. 564, 565*).

Composition of commercial fertilizers, H. B. MCDONNELL ET AL. (*Maryland Sta. Bul. 45, pp. 50*).—This bulletin gives a schedule of trade values of fertilizing materials, a list of fertilizers licensed for sale in Maryland for the year ending January 31, 1897, and tabulated analyses and valuations of 416 samples of fertilizers.

Some inferior wood ashes, F. W. MORSE (*New Hampshire Sta. Bul. 43, pp. 27–29*).—Analyses of 14 samples of Canada ashes, 4 of domestic ashes, and 2 of refuse ashes are reported, with comments on the variability in the composition of wood ashes, and especially on certain fraudulent lots of Canada ashes which were examined by the station.

Composition and use of fertilizers, L. L. VAN SLYKE (*New York State Sta. Rpt. 1895, pp. 37–148*).—This is a reprint of Bulletin 94, new series, of the station (E. S. R., 7, p. 853).

Analyses of commercial fertilizers collected in 1895, L. L. VAN SLYKE (*New York State Sta. Rpt. 1895, pp. 156–229*).—Analyses of 260 samples of fertilizers collected during the spring of 1895 and 288 samples collected during the fall of 1895 are tabulated.

Analyses of commercial fertilizers, J. L. HILLS, B. O. WHITE, and C. H. JONES (*Vermont Sta. Bul. 57, pp. 19–31*).—Brief notes on valuation of fertilizers, a list of fertilizer firms licensed under the provisions of the State fertilizer law, and tabulated analyses and valuations of 35 samples of fertilizers.

Comparative field tests of commercial fertilizers used in raising potatoes (*New York State Sta. Rpt. 1895, pp. 25–36*).—A reprint of Bulletin 93 of the station (E. S. R., 7, p. 761).

Field trials with artificial fertilizers, K. HANSEN (*Tidskr. Landökon, 16 (1897), pp. 184–218*).

Results of experiments in 1896 with mixtures of phosphates and nitrate of soda, L. GRANDEAU (*Jour. Agr. Prat., 61 (1897), I, No. 10, pp. 345–349*).—This is a continuation of the work of previous years (E. S. R., 7, p. 755), and summarizes the reports of experiments in 22 departments of France with nitrate of soda as a spring fertilizer in connection with applications of potash and phosphoric acid. The results on winter wheat, oats, potatoes, fodder beets, sugar beets, and hay confirm in general the favorable conclusions from previous experiments, notwithstanding the fact that the preceding autumn and winter were very wet. The use of nitrate, especially in connection with slag and superphosphate, enabled the crop to overcome the effects of the unfavorable season and give profitable returns.

The New York fertilizer law and its meaning, L. L. VAN SLYKE (*New York State Sta. Rpt. 1895, pp. 149–155*).—The text of the State fertilizer law is given and its different provisions are explained.

Potash manuring: Its value to British agriculture, C. M. AIKMAN and R. P. WRIGHT (*Glasgow: Carter & Pratt, 1896, pp. 50, figs. 14*).—Having satisfied themselves "that the artificial potash manures have been too much neglected in ordinary agricultural practice," the authors have "collected a number of experiments on the manuring of the more important farm crops which show the beneficial effects that have been produced under certain conditions from the employment of potash manures." The principal sources of data are the experiments of Lawes and Gilbert and Voelcker, sr. and jr., in England, and Aitken in Scotland, special prominence being given to results obtained by the latter in connection with the Highland Society and "to those obtained in the numerous experiments carried out during the last few years in the west of Scotland by the agricultural department of the Glasgow and West of Scotland Technical College.[1] These data supply a contribution to the study of the subject which should be regarded as fragmentary and suggestive rather than comprehensive and final," because the subject has not yet been thoroughly investigated under all conditions of soil, climate, and crop.

The first chapter deals with potash in soils and crops—nature and sources of potash manures; and the second with effects of potash manuring on the common British crops, the latter including grass, clover, beans, oats, barley, turnips, potatoes, and mangel-wurzels.

FIELD CROPS.

Corn: Cultural investigations and comparison of varieties, J. F. HICKMAN (*Ohio Sta. Bul. 78, pp. 53–91*).—The cultural investigations consisted of comparisons of deep with shallow plowing, distribution of seed, kernels from different parts of the ear used as seed, methods of cultivation, detasseling, and maturing in the shock and on the stalk. The average rainfall and temperature for the 5 months of the corn season for 9 years are given, and the results of all experiments are tabulated.

Plats plowed 3 and 7 in. deep gave results so similar that no effect could be ascribed to the difference in depth of plowing. Three-year experiments indicated that planting 1 grain every 12 in. and 2

[1] Reports on experiments on the manuring of farm crops in 1893, 1894, and 1895, Wright et al.

grains every 24 in. was better than planting 3 grains every 36 in. and 4 grains every 42 or 48 in. Rows were about 3½ ft. apart. Growing 1 stalk every 18 in. gave a higher percentage of sound corn, but it reduced the total yield.

Experiments with seed from different parts of the ear covered a period of 9 years. Each year seed was taken from butts of ears grown from butt grains, and in like manner middles from middles and tips from tips. The results differ immaterially. The average increase for surface cultivation was 6 bu. per acre as compared with deep tillage. A number of experiments were made at other stations, and the results are given in the table. The general tendency of detasseling corn was to reduce the yield. Results of experiments in detasseling at other stations are tabulated.

Different methods of harvesting were tried at the station and in various sections of the State. The results seem to indicate that there is but slight difference in the yield of grain between corn cut and shocked, provided it is sufficiently mature at cutting time, and that left standing. They also indicate that varieties not sufficiently mature at cutting time will give the best results when cut and shocked.

A comparative test of varieties was carried on for 5 years. The author separates the 76 varieties tested into 2 general divisions, namely, yellow and white dent, and under each of these the varieties are classified as large, medium, and small. The Clarage variety was used as a standard of comparison. In the large yellow dent class, Bristol 100-day corn produced a heavier yield than the Clarage, and Murdock Favorite, a lighter yield. These 2 were the only varieties that matured every year they were grown. Big Buckeye, Chester County Mammoth, Cloud Early, Golden Beauty, Farmer Favorite, Early Mastodon, Pennsylvania Early, Hughes, Waterloo Early, and Early Eclipse produced larger yields than the standard variety, but they did not mature every year. In the medium yellow dent class Early Colossal was equal in productiveness to the Clarage, all the other varieties of this class giving smaller yields. From the large white dent class, Early White Dawn, Hickory King, Hess White, and Maryland White Dent are recommended for southern Ohio, and the Maryland White Dent, Rustler White, and Early White Dent for the northern part of the State as far north as the forty-first parallel. White Cap and White Prolific from the medium and small white dent class are not profitable where the Clarage will mature.

Method of determining comparative yields in variety tests of corn, W. J. Fraser (*Illinois Sta. Bul. 46, pp. 352–355*).—One variety grown on 13 different plats located in a uniform field, 10 by 40 rods in extent, gave yields varying from 45.8 bu. to 100.8 bu., and yields on contiguous plats varied from 65.3 bu. to 89.7 bu. per acre. Variations in yields were greater from small than from large plats. It is concluded that differences in the soil interfere with variety tests and a method for the elimination of errors has been tried.

Plantings were made in strips to eliminate the effect of soil differences in one direction. The same variety was planted on every third strip for comparison to eliminate lateral differences. The strips were harvested in sections to locate abnormal places. The tables show the total yields of all varieties, the computed yields of the check variety, if it were grown over the whole field, and the yields corrected as the check variety was above or below the average. Variations due to soil differences are thus believed to be almost entirely eliminated.

Experiments with corn, W. J. FRASER (*Illinois Sta. Bul. 46, pp. 349–352*).—Cultivation experiments were made on a small field divided into 10 plats and planted with Burr white corn. From one plat the weeds were removed but no cultivation was given; one plat was mulched with grass 6 in. deep after the first cultivation; another was cultivated deeply with a double shovel plow, and the remaining plats were cultivated from 1 to 6 in. deep with a harrow-toothed cultivator.

The results show a great indifference to cultivation. The 3 highest yields were from the mulched plat, the uncultivated plat, and the plat cultivated 6 in. deep. Ideal conditions as to moisture existed during the season and made cultivation of less importance.

Corn and potato experiments, R. H. MILLER and E. H. BRINKLEY (*Maryland Sta. Bul. 46, pp. 55–69*).—Tabulated results of cultivation, distance, and fertilizer experiments with corn and potatoes and of variety tests of potatoes are given.

Corn.—Commercial fertilizers did not give sufficient returns to be profitable. Crimson clover plowed under increased the yield 6.7 bu. per acre, and where plowed under for 2 years in succession 46 bu. per acre were obtained the first year and 53.4 the second year.

The cultivation experiment gave but slightly varying results. The average yield for 3 years was 49.5 bu. per acre for drilled and 44.9 for checked corn.

Potatoes.—Forty-one early varieties were tested and Holten Rose was grown on every sixth plat as a check. Vanguard, Summitt, Milwaukee, Irish Cobbler, Lee Favorite, and Early Maine in the order named produced the largest crops.

A complete fertilizer proved most effective. Sulphate of potash proved more effective than muriate of potash or kainit.

Cultivation tests resulted in but slight differences in yield. The rows $2\frac{1}{2}$ ft. apart, with 14 in. between plants in the row, yielded on an average for 3 years 100.5 bu. per acre, as compared with 78.7 bu. for rows 3 ft. apart, with 12 in. between plants.

Field experiments with corn, cotton, and forage plants, J. H. CONNELL and J. CLAYTON (*Texas Sta. Bul. 40, pp. 851–874*).—This is in part a continuation of work reported in Bulletin 34 of the station (E. S. R., 7, p. 114). The experiments were made on a black sandy and poorly drained soil. The corn and cotton were grown on tenth-acre plats, every fifth plat containing the same variety as a check.

Corn.—Tests were made with 62 varieties grouped as common field, early, extra early, and prolific. Descriptions are given for a number of varieties, and for each group the 5 best yielding varieties and those yielding more than 25 bu. per acre are given. Mosby Prolific, Blount Prolific, Forsyth Favorite, Golden Beauty, and Murdock gave best yields, ranging from 48 to 43.8 bu. per acre. Yields of 35 varieties also grown the previous year are compared and the proportion of shelled corn to ear corn is given.

Cotton.—Of 34 varieties plantings were made April 10 and May 17, 1895. The well-known Bohemian was grown as a check. The results are tabulated. At $8\frac{1}{4}$ cts. per pound Peerless brought $31.26 per acre, an excess of $10.12 over the check variety.

Forage plants.—Varieties of grass, clover, sorghum, Kafir corn, millet, cowpea, soja bean, buckwheat, and broom corn were grown on twentieth-acre plats. Mesquite grass grew well, while lentil, sainfoin, serradella, and yellow lupine proved failures at the station. Giant beggar weed is too woody for forage. The experiment has not yet been completed.

Experiments with cotton, J. F. DUGGAR (*Alabama College Sta. Bul. 76, pp. 23*).—The experiments include variety tests, seed tests, methods of cultivation, distance experiments, and experiments with fertilizers. Results are tabulated and average yields of lint and of varieties tested more than 10 times are given. All experiments were made on plats varying from one-twenty-first to one-fifteenth of an acre in different fields.

Varieties (pp. 6–10).—Seventeen varieties were grown under like conditions. Hutchinson ranked first with a yield of 845 lbs. of seed and 403 lbs. of lint per acre. Truitt, Dixon Cluster, and Peerless stood next in the order named. Wellborn Pet, Dixon Cluster, and King, in the order named, proved to be the earliest varieties. King afforded the highest per cent (35.1) of lint.

Seed (pp. 10–12).—Yields from seed obtained from different latitudes varied slightly in favor of seed from the most northerly locality. Seeds grown in 1893, 1894, and 1895, were planted to test the effect of age on seed. The results varied so little as to warrant no conclusion. New seed usually insures a better stand.

Cultivation (pp. 12–14).—Rolling after planting induced simultaneous germination and a good stand. Barring off under favorable moisture conditions did not prove deleterious. Subsoiling gave an increase of 46 lbs. of lint and 93 lbs. of seed per acre over the yield of land not subsoiled, under conditions favorable to subsoiling.

Distance experiments (pp. 14, 15).—All rows were $3\frac{1}{2}$ ft. apart and the best yields were in favor of distances ranging from 12 to 18 in. between the plants in the row.

Fertilizer experiments (pp. 16–23).—Bedding on all the fertilizer gave slightly better results than reserving one-third and applying it in the seed drill at planting time. A mixture and a compost containing per ton 333 lbs. acid phosphate, 333 lbs. crushed cotton seed, and 1,334 lbs. fine horse manure were applied at the rate of 2,835 lbs. per acre. The ingredients of the mixture were applied separately and mixed in the furrow about one month before planting, while the compost was applied immediately before planting. The application of the mixture gave the best results, probably due to a great extent to the fact that in this case there was a settled seed bed at planting time, while the compost plat had been recently plowed and was loose.

To 10 plats various fertilizer mixtures were applied. The quantity per acre of the fertilizers in the different mixtures was 200 lbs. of cotton-seed meal, 240 lbs. acid phosphate or Florida soft phosphate, 200 lbs. of kainit, 472 lbs. of crushed cotton seed, and 600 lbs. of slaked lime. On 1 plat 600 lbs. of kainit per acre was used. The cotton-seed-meal mixture proved most profitable. Florida soft phosphate proved inferior to acid phosphate, and slaked lime gave no increase of yield either on gray, sandy, or red soil.

Some forage, fiber, and other useful plants, G. McCarthy (*North Carolina Sta. Bul. 133, pp. 339–353*).—This is a continuation of work described in Bulletin 98 of the station (E. S. R., 6, p. 34). The following plants were tested at the station and descriptions, with notes on their growth, are given: Cowpea, rice pea (*Dolichos sinensis*), banana pea (*Dolichos multiflorus*), Pearson bean (*Phaseolus* sp.), hagy (*Lespedeza bicolor*), hairy lespedeza (*Lespedeza sericea*), broad-leaved Japan clover (*Lespedeza striata*), beggar weed (*Desmodium tortuosum*), chicory (*Cichorium intybus*), fenugreek (*Trigonella fœnum-græcum*), horse bean (*Vicia faba*), Canada field pea (*Pisum sativum*), spring vetch (*Vicia sativa*), hairy vetch (*Vicia villosa*), furze (*Ulex europea*), broom (*Genista scoparia*), spurry (*Spergula arvense* and *S. maxima*), burnet (*Poterium sanguisorba*), sachaline (*Polygonum sachalinense*), flat pea (*Lathyrus sylvestris*), sesame (*Sesamum indicum*), madder (*Rubia tinctorum*), rape (*Brassica campestris*), madia (*Madia sativa*), fuller's teasel (*Dipsacus fullonum*), cañaigre (*Rumex hymenosepalus*), jute (*Corchorus capsularis*), Japan hemp (*Cannabis sativa, japonica*), Persian hemp (*Cannabis sativa, persica*), Kentucky hemp (*Cannabis sativa*), ramie (*Urtica nivea*).

The "Unknown" and "Red Ripper" cowpea were grown at the station and at various places throughout the State. The author recommends them for forage and green manuring. The "Unknown" is better for table use. Rice pea, broad leaved Japan clover, beggar weed, chicory, Canada pea, fuller's teasel, Japanese hemp, and jute made promising growth. Hairy lespedeza, fenugreek, horse bean, hairy vetch, furze, common hemp, spurry, broom, madder, Russian rape, sachaline, flat pea, sesame, and burnet have not proven to be of much practical value. Persian hemp runs to seed rather than fiber. Madia is considered as probably a valuable forage for sheep. The value of cañaigre is as yet undetermined. Ramie grown from seed was not successful.

Experiments with oats, C. C. GEORGESON, F. C. BURTIS, and D. H. OTIS (*Kansas Sta. Bul. 63, pp. 213–226*).—The oat crop for the season of 1896 was almost completely ruined by rust, which developed to an extraordinary degree owing to hot weather and light showers between June 10 and the maturing of the crop.

The lines of experiment were the comparison of oats on land plowed in the fall and in the spring and on unplowed land, relative production from seeding at different dates and with different amounts and different qualities of seed, test to ascertain effect of changing soils on the percentage of smut, trials of methods of seeding, comparison of oats and barley, and variety tests. Full tabulated data are given for each experiment, with averages for previous years. The authors give the following summary for a number of years:

"(1) In 4 successive years the best yields of oats have been obtained on spring-plowed land, while when the seed is drilled in there has been practically no difference in the yield in these years between fall-plowed land and land not plowed at all. The oat land had in all cases been in corn the previous year and the corn had been well cultivated.

"(2) The past season the seedings made the first and second week in March gave the best yields. While the time of seeding must necessarily depend upon the weather, as a rule it is best to sow oats as early in March as the ground can be put in order.

"(3) Light, inferior seed is certain to produce less than seed of fair quality, but between a fair quality of seed oats and heavy, sifted seed there is not very much difference, the best yields during 7 years having sometimes been produced by one and sometimes by the other. The average for 7 years is, however, in favor of the heavy seed.

"(4) In an average of 6 years, no other method has produced so good results as seeding with a shoe drill with press wheels; next follow in order shoe drill without press wheels, hoe drill, and broadcasting.

"(5) The average of 6 years indicates that it is not advisable to sow less the 2.5 bu. per acre. Heavier seedings have in some years yielded more, in others less, than has that amount, but the increase in yield by heavier seeding does not appear to more than cover the additional amount of seed used over 2.5 bu. per acre.

"(6) Smutted seed oats produce smut in the crop, even though the soil is changed. Of the 8 varieties of smutted oats obtained from the Ohio station for this test, the percentage of smut was increased above that contained in the seed in 5 varieties. The theory that a change in soils will clear the oats of smut is, therefore, false.

"(7) Barley has never as yet produced a satisfactory yield at this station.

"(8) The average yield for 6 years past places the best yielding 12 varieties of oats tested here in the following order: Belgian, Brown Winter, Board of Trade, Red Georgia, Pedigree Red Rust Proof, Golden Sheaf, White Side, Northwestern White, Red Rust Proof, Yankee Prolific, Welch, and Black American."

Potatoes, W. J. GREEN (*Ohio Sta. Bul. 76, pp. 33–48*).—Extended notes on culture, descriptions of 28 varieties, and tabulated results with fertilizer experiments are given.

Cultural notes.—Selection and keeping of seed potatoes is considered more important than the use of seed grown on a different soil. The ideal way of keeping seed is believed to be in cold storage at about 35° F. Properly stored seed will give a good crop even if planted late. Several weeks before planting the seed should be spread one layer deep in the light (but not direct sunlight) to quicken its growth when planted. A one-hour immersion in corrosive sublimate solution suffices to prevent scab. Spraying against blight gives various results, probably due to different forms of the disease. Thorough cultivation produces vigorous growth, thus giving resistance to blight.

Variety tests.—American Wonder, Carman Nos. 1 and 3, Early Norther, Early Harvest, Rural New Yorker No. 2, Sir William, and Wise are recommended for general cultivation.

Experiments with fertilizers.—Superphosphates proved profitable, the cost per bushel of increase being 5 to 6 cts. Dissolved boneblack and acid phosphate were of about equal efficiency. Slag phosphate gave lower average results than the other forms. Wheat bran was preferable to linseed meal. Nitrate of soda and muriate of potash when used singly gave small increase. Superphosphate, nitrate of soda and muriate of potash gave best results when used in combination, the increase being nearly in proportion to the quantity used up to 1,100 lbs. per acre.

Experiments with potatoes, B. D. HALSTED (*New Jersey Stas. Bul. 120, pp. 7–10, figs. 3*).—Tests were made of the value of the different methods of cutting the seed, of different depths of planting, and of irrigating. Three varieties of potatoes were used in each experiment. The results are given in tabular form.

For testing the effect of depth of planting, seed was planted at the depths of 4, 6, and 8 in. The 6-in. planting gave somewhat the largest yield and the 8-in. planting the next largest. The author thinks, however, that the increased yield is overbalanced by the greater cost of planting and harvesting when the depth is over 4 in. The yield of potatoes was practically the same on irrigated and unirrigated plats, but the percentage of scabbed potatoes was greater on the former.

To determine the effect of different methods of cutting the seed, one plat was planted with cuttings from the bud end of potatoes, one with cuttings from the stem end, and one with the middle pieces. The relative yield of potatoes cut by the different methods is given in the following table:

Yields of potatoes from different cuttings.

	Bud end.	Middle.	Stem end.
Early Rose	66.0	80.5	55.5
American Giant	37.5	55.0	31.0
Rural No. 2	94.0	123.5	100.5
Total	197.5	259.0	187.0

Field experiments on hay, pasture, potatoes, swedes, and mangels, D. A. GILCHRIST and P. H. FOULKES (*Jour. Univ. Extension Col., Reading* [*England*], *pp. 3–32*).—These experiments (mainly fertilizer trials) are carried on in different shires and are to extend over a period of 5 years. The results obtained during the season of 1895 are tabulated and chemical analyses of the fertilizers and the soils are given.

Commercial fertilizers were applied to 21 hay and pasture plats. The best results were obtained from phosphate manures. Basic slag proved more effective and lasting than superphosphates.

Commercial fertilizers produced an increase of the potato crop at a much less cost than barnyard manure. The best results were obtained from a complete fertilizer consisting of 20 tons barnyard manure, 100 lbs. ammonium sulphate, 200 lbs. superphosphate, and 200 lbs. potassium sulphate.

Manurial experiments in various parts of Scotland (*Trans. Highland and Agl. Soc., Scotland, ser. 5, 7 (1895), pp. 436–459*).—Experiments were made in 1894 with turnips, beans, and oats.

Turnips.—Seventy-eight experiments were made by the Banffshire farmers—41 with commercial phosphatic and nitrogenous fertilizers, and 37 with the amount of commercial fertilizers reduced to one-half and barnyard manure added. Bone meal, superphosphate, and slag were applied with nitrate of soda and sulphate of ammonia. On one plat a mixture of superphosphate and slag was applied at the rate of 7½ cwt. per acre without any nitrogenous fertilizer and this plat proved the most profitable. A further addition of 1 cwt. of nitrate of soda per acre increased the crop by nearly 2 tons per acre; but when this amount of nitrate was doubled, the increase was not relatively large enough to warrant such a practice. It is stated that the rains washed away some of the nitrate before the roots could utilize it. Sulphate of ammonia was found to be better than nitrate of soda during wet seasons. Superphosphate, or a mixture of superphosphate and slag was found to be the best of the phosphatic fertilizers. The barnyard manure seemed to have no advantage over the commercial fertilizers. An application of 20 tons per acre produced an average of 16½ tons—the amount obtained from the plat to which superphosphate and slag only had been applied.

One experiment was made to determine the efficacy of natural phosphates when applied in the same state of fineness. The results placed the phosphate fertilizers in the following order: Superphosphate, slag, Carolina (Charleston), phosphatic guano, Algerian, Belgian, Florida (Peace River), and Florida rock.

Beans.—An experiment to test the utility of potash, lime, and green vitriol (sulphate of iron) as ingredients in a bean manure was made. Green vitriol did not seem to be of any special value to the crop.

Oats.—This experiment was made to determine the value of muriate of potash and superphosphate as a preparation for lea oats, and the advantage of applying the manure about two months before sowing. The results indicated that the increase in yield due to the superphosphate was very slight, and that due to muriate of potash was insignificant, but sulphate of ammonia gave a considerable increase. It was also shown that potash and superphosphate, and even sulphate of ammonia may be applied advantageously some weeks before sowing.

Another experiment was made to discover how best to manure the oat crop without impairing the quality of the grain or the strength of the straw. Superphosphate, muriate of potash, common salt, nitrate of soda, and a mixture of nitrate of soda and sulphate of ammonia were used as fertilizers. The grain on plats top-dressed with nitrate of soda lodged worst; an addition of muriate of potash did not prevent lodging, but common salt gave satisfactory results in this respect.

Coffee growing, C. SKELTON (*Agl. Gaz., N. S. Wales, 8 (1897), No. 1, pp. 56-58*).

Attempts to grow crimson clover, E. DAVENPORT (*Illinois Sta. Bul. 46, pp. 355-357*).—Crimson clover does not succeed as well in Illinois as red clover, being more subject to drought and cold, especially when small. Noticeable benefits from acclimation are as yet unestablished.

New or noteworthy American grasses, VI, G. V. NASH (*Torrey Bul., 24 (1897), No. 4, pp. 192-201*).—Notes and descriptions are given of several species of Panicum.

Experiments with potatoes, F. W. RANE and L. HUNT (*New Hampshire Sta. Bul. 41, pp. 1-14*).—Eighty varieties were tested. Results are tabulated and notes on all varieties given. Muriate and sulphate of potash proved equal in value as fertilizers. Corrosive sublimate treatment reduced the percentage of scabby potatoes.

Potato experiments, 1896, B. R. LARSEN (*Norsk Landmansblad, 16 (1897), pp. 230-232*).

Potato culture trials, 1896, B. R. LARSEN (*Tidsskr. norske Landbr., 4 (1897), pp. 105-113*).

Instructions for growing sugar beets from the seed furnished by the Iowa Experiment Station, C. F. CURTISS (*Iowa Sta. Circ., pp. 4*).—This is a circular sent out with seed and contains suggestions as to the kind of soil and its preparation, planting of the seed, the cultivation and harvesting of the crop, and the manner of securing samples for analysis.

Experiments in sugar beet culture in Norway, F. H. WERENSKIOLD (*Tidsskr. norske Landbr., 3 (1896), pp. 449-471*).

Culture of sugar cane in central France, J. GAISSET (*Prog. Agr. et Vit., 27 (1897), No. 13, pp. 398-400*).

Sugar beet analyses, PELLET (*Sucr. indigène, 49 (1897), Nos. 13, p. 362; 16, p. 458; abs. in Chem. Ztg., 21 (1897), No. 39, Repert., p. 116*).

Tobacco in Florida, F. B. MOODIE (*Florida Sta. Bul. 38, pp. 411-459*).—This is a reprint, with additions, of Bulletin 30 of the station (E. S. R., 7, p. 763).

Concerning the influence of fertilizers upon the amount and composition of the ash of cultivated plants, P. OEHMICHEN (*Ueber den Einfluss der Düngung auf die Menge und die Zusammensetzung der Asche verschiedener Culturpflanzen. Inaug. Diss. Leipzig, 1896, pp. 104; abs. in Bot. Centbl., 69 (1897), No. 12, pp. 392, 393*).

The iron content of plant ash, B. NIEDERSTEDT (*Forsch. Ber. Lebensmittel, 4 (1897), No. 5, p. 140*).—The author reports the iron content of the ash of coffee beans and of a number of samples of American evaporated apples.

The permanent effects of manures upon meadow land as shown by the relative abundance of grass and clover in the pasture, and the manner in which it is eaten by stock (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 7 (1895), pp. 423-432*).

The application of nitrate of soda when clover is grown with other crops (*Landw. Wochenbl. Schles. Holst., 47 (1897), No. 16, p. 249*).—The methods and the time of application to avoid injury to the clover are given.

Experiments with root crops grown continuously, Barnfield, Rothamsted, Sir J. H. GILBERT (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 7 (1895), pp. 19-137*).—See also U. S. Dept. Agr., Office of Experiment Stations Bul. 12 (E. S. R., 7, p. 387.

The experiments on rotation made at Rothamsted, J. B. Lawes and Sir J. H. Gilbert (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 7 (1895), pp. 195–254*).—See also Jour. Royal Agl. Soc. England, 3. ser., 5 (1894), No 20, pp. 585-646 (E. S. R., 6, p. 893.)

The cereal and other crops of Scotland in 1894 (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 7 (1895), pp. 373–397*).—Crop reports from various shires.

Experiments on the growth of wheat for more than 50 years in succession on the same land, Broadbalk Field, Rothamsted, Sir J. H. Gilbert (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 7 (1895), pp. 166–195*).—See also U. S. Dept. Agr., Office of Experiment Stations Bul. 22 (E. S. R., 7, p. 390).

Memoranda of the origin, plan, and results of the field and other experiments conducted on the farm and in the laboratory of Sir John Bennett Lawes, at Rothamsted, England, Sir J. H. Gilbert (*A report to the Lawes Agric. Trust Co., pp. 105*).—This report gives the history and a description of the Rothamsted Experiment Station. The year 1896 was the fifty-third year of the experiments, and tables of results obtained during the whole period are given. This work has been fully described and the results tabulated in Bulletin 22 of this office (E. S. R., 7, pp. 385–394).

HORTICULTURE.

Forcing cauliflower with lettuce and cucumbers, H. C. Irish (*Proc. Soc. Promotion Agl. Sci., 1896, pp. 41–47*).—This is a report of an experiment made at the Missouri Botanical Garden to test the possibility of profitably forcing cauliflower with lettuce and cucumbers. Three crops of cauliflower and lettuce were grown between October 1 and June 1, new plants being started in time to replace the old ones as soon as they were removed. The cauliflower plants were set 18 in. apart with rows of lettuce between them each way. The soil for the first crop was 1 part rotted manure and 3 parts heavy black loam. For the other two crops, about half manure and half loam were used. The heads of cauliflower were large for forced crops, the estimated average weight being over 1¼ lbs. per head. In the first crop, the lettuce was crowded out, but in the richer soil of the second crop, 90 per cent of the plants developed good heads. Cucumber plants were set around the sides of the benches at about the time the second crop of cauliflower and lettuce was removed. The maximum amount of fruit from one vine was about 32 lbs. Other vines also did well, but some were worthless. The results seemed to indicate that at the usual St. Louis prices these vegetables when raised together can be forced with profit.

Descriptions of the house and manner of growing the vegetables are given in detail, together with notes on insect and fungus enemies. An estimate of probable profits to be derived from forcing these vegetables is made.

Tomato growing in New Hampshire, F. W. Rane and L. Hunt (*New Hampshire Sta. Bul. 42, pp. 15–24, figs. 2*).—This bulletin gives the results of tests of 56 varieties of tomatoes grown during the season of 1896. A table is given showing the average yield per plant, date of first ripe fruit, average weight of each fruit, percentage of rot, and average weight of green fruit per plant Septemper 24, for each variety. Brief descriptive notes are given on the varieties tested. The fruit of each variety is illustrated. The author concludes that the varieties best suited to New Hampshire are those which mature the bulk of their fruit by September. The varieties that did best, named in order of productiveness, are Early Michigan, Acme, Brinton Best, Beauty, Red Cross, Waldorf, Fordhook First, Stone, and County Fair.

Apple growing in New Jersey, E. B. VOORHEES (*New Jersey Stas. Bul. 119, pp. 23*).—This bulletin is the outgrowth of the statistical fruit survey of the State made in 1895. Its purpose is to give the methods of culture and marketing at present employed in the State, and to point out some of the underlying principles of successful culture.

In regard to the kinds of soil on which apples are successfully raised, the census replies differ widely. Fifty-three per cent of them give sandy or gravelly soil and subsoil, 13 per cent sandy soil with clay subsoil, 22 per cent clay soil and subsoil, and 12 per cent clay loam soil with clay subsoil. A porous soil overlaying a subsoil not too compact is recommended by the author as a good type for apple culture. High land with northwest exposure is favored by a majority of the apple growers of the State.

The selection of varieties is discussed with reference to soil, location, demands of the market, etc. In small orchards for supplying the local markets, a greater number of varieties may be grown to advantage than in large ones located at a distance from market. The census replies in regard to the best market varieties mentioned 114 different kinds, the great majority of them being noted by only a few reporters. The 15 leading varieties for the whole State are given with the number of times each is mentioned in the reports. Lists of the 10 best varieties for each, the northern, central, and southern, section of the State are given.

Under the head of setting the orchard, the author discusses the preparation of the soil, age of trees, time of setting, and distance between trees. The distance apart at which trees are set varies greatly according to the kind of soil, habit of growth of the trees, etc., the tendency being toward close setting with severe pruning. Census replies as to the time of setting, distance apart, and age of trees are given for the different sections of the State. Two-year-old trees are preferred on the stronger soils and 3-year-old ones on the lighter soils.

The time and methods of pruning, methods and advantages of cultivation are discussed, and the practice of orchardists in regard to pruning and cultivating, as shown by the census, is given. On the richer soils a small majority of the orchards are in sod, while on the poorer soils a large majority are cultivated. In a similar way the bulletin treats of the need of manuring, kinds and amounts of manure used, and the relative value of barnyard manure and commercial fertilizers for different parts of the State. The advantages of proper grading and attractive packing of fruit for market is emphasized. Thinning fruit to produce a better quality is strongly recommended. Analyses are given which show that a bushel of small apples removes more plant food from the soil than a bushel of large ones.

The minimum, maximum, and average yield of apples, the expense of production, and gross and net returns from crops per acre in 1893 and 1894 are given for the three sections of the State. The average net value of the apple crop for the two years, without considering the expense of shipment and selling, was from $40 to $50 per acre. As an example of possible results from good methods of management may be cited a single orchard of 30 acres which gave a net return of $97.50 per acre.

The bulletin concludes with a number of practical suggestions as to methods of management.

Fruit culture in South Dakota, N. E. HANSEN *South Dakota Sta. Bul. 50, pp. 40*).—This is a popular bulletin intended to serve as a guide to planters in the State. Descriptions of the varieties of apples recommended by the Minnesota State Horticultural Society are given, together with remarks on their hardiness in South Dakota. Notes are given on the behavior of several varieties which fruited at the station in 1896. The relative merits of budding, whole-root grafting, and piece-root grafting are discussed, the latter being recommended. A general discussion is also given of soil, location, and exposure of orchards, age and size of trees for planting, time and methods of planting, cultivation, pruning, injuries from mice, rabbits, borers, and climbing cutworms, with remedies for each, etc.

Under the head of plums, remarks are made on the improvement of the wild plums and on the varieties which have originated from them. The relative merits of different stocks for budding plums are discussed, the only one considered reliable by the author being *Prunus americana*. Location and soil for orchards, and pruning and care of trees are considered. Brief notes are given on several varieties of plums which fruited at the station in 1896.

Remarks are made on the possibilities of cherry culture in the State. Notes are given on the varieties and culture of grapes, currants, gooseberries, raspberries, blackberries, and strawberries. The improvement of native fruits is briefly considered.

The bulletin also contains reports from a number of fruit growers in different parts of the State. In these reports, made in response to inquiries sent out by the stations, the several growers give their experience with fruit culture in the State.

Thinning fruits, S. T. MAYNARD, J. H. PUTNAM, and S. W. FLETCHER (*Massachusetts Hatch Sta. Bul. 44, pp. 24–26*).—Two Gravenstein apple trees of uniform vigor and productiveness and two uniform Tetofsky apple trees were selected and the fruit of one tree of each variety was thinned July 1, the other trees being left unthinned as checks. The following table gives the difference in yield and value of apples on thinned and unthinned trees:

Results of thinning apples.

	First quality.	Second quality.	Wind-falls.	Market value.	Gain.	Cost of thinning.	Net gain.
Gravenstein:	*Bushels.*	*Bushels.*	*Bushels.*				
Thinned	7	1	9½	$4.45	$2.33	$0.48	$1.85
Unthinned	2½	2½	10¼	2.12			
Tetofsky:							
Thinned	2	½	1	1.32	1.20	.35	.85
Unthinned		½	3	.12			

A tree each of Guei and Victoria plums was divided into approximately equal halves; one-half of each tree was thinned July 1 and the other half left as a check. The results are shown in the table following:

Result of thinning plums.

	Market-able fruit.	Value.	Gain.	Cost of thinning.	Net gain.	Percentage of fruit rotted.
Guei:	*Quarts.*					
Thinned	9	$0.81	$0.32			28
Unthinned	5½	.49				42
Victoria:						
Thinned	16	1.44	.59			20
Unthinned	9½	.85				46
Total			.91	$0.30	$0.61	

Variety tests of fruits, S. T. MAYNARD, J. H. PUTNAM, and S. W. FLETCHER (*Massachusetts Hatch Sta. Bul. 44, pp. 3–24*).—*Apples.*—A list is given of the varieties fruited in 1896. Brief descriptive notes are given on those showing special merit.

Grapes.—Many varieties were injured by the winter of 1895. There was a very noticeable difference in the injury to the sprayed and unsprayed vines, probably due to the fact that the unsprayed plants, being affected more by disease, did not mature their wood as well as the sprayed plants. The spraying had a greater effect on the crop of the year following the treatment than on that of the season in which the application was made. Seventy-two sprayed vines of as many varieties produced 187 lbs. of fruit, while 72 unsprayed vines of the same varieties produced but 118 lbs. A table is given comparing 97 varieties as regards vigor, hardiness, resistance to disease, yield and quality of fruit, time of ripening, adhesiveness, keeping qualities, etc. Notes are given on some of the new varieties.

Gooseberries.—Descriptive notes are given on 12 American and 5 English varieties. Their relative vigor and productiveness and the comparative size and quality of their fruit are shown in tabular form. The English varieties were found to be, on the whole, less vigorous and productive and more subject to disease than the American varieties. The varieties recommended for general culture, in the order of their value, are Lewis Roesche, Triumph, Downing, Columbus, Chautauqua, and Crown Bob.

Currants.—Seventeen varieties are compared as regards their vigor, productiveness, and size and quality of fruit.

Blackberries and raspberries.—Tabular statements are given of the time of ripening, quality and size of fruit, vigor of plants, and percentage of winter-killed canes of 21 varieties of black raspberries, 13 varieties of red raspberries, and 17 varieties of blackberries. Descriptive notes are given on a few varieties of each.

Strawberries.—A table is given showing the sex, vigor, and productiveness of plants, dates of blooming and ripening, size, form, quality, firmness, and color of fruit of 158 varieties of strawberries. Descriptive notes are given on 26 of the more recent varieties.

New small fruits.—Notes are given on the Golden Mayberry, Loganberry, Salmonberry, Strawberry-raspberry, Japanese wineberry, Dwarf Juneberry, and Dwarf Rocky Mountain cherry.

Testing fruits, S. A. BEACH (*New York Sta. Rpt. 1895, pp. 249–320, pls. 11*).—The importance of variety tests is briefly discussed, and a table is given showing the number of varieties of fruits grown and the number fruiting at the station in 1895.

Apples and crab apples (pp. 251–266).—A table is given showing the yield in 1895, the age of trees or grafts, and the season of ripening of 210 varieties of apples and 23 varieties of crab apples. Descriptive notes are given of 15 of these varieties.

Pears and quinces (pp. 267, 268).—A list of 140 varieties of pears and 10 varieties of quinces growing in the station orchards in 1895 is given.

Apricots (pp. 268–274, pls. 5).—A table is given comparing the average length of life of common apricots, Russian apricots, and common plums, all grown under similar conditions. In another table a comparison is made of the productiveness of common and Russian apricots in 1895. At the station the plums have been longer lived and much more fruitful than apricots. Russian apricots have been longer lived and more productive than common ones, but not as good in either appearance or quality. Descriptive notes are given on 9 varieties of apricots fruited at the station in 1895. Five of these are illustrated. A list of 20 varieties grown at the station in 1895 is given.

Grapes (pp. 274–280).—A continuation of the work reported in the Annual Report of the Station for 1894, pp. 601–607 (E. S. R., 8, p. 601). Descriptive notes are given of 26 varieties of grapes fruited at the station in 1895.

Currants (pp. 280–302, pls. 6).—A reprint of Bulletin 95 of the station (E. S. R., 8, pp. 52, 53).

Blackberries, dewberries, raspberries, and strawberries (pp. 302–320).—A reprint of Bulletin 91 of the station (E. S. R., 7, pp. 502, 503).

The home vegetable garden, W. F. MASSEY (*North Carolina Sta. Bul. 132, pp. 279–325, figs. 2*).—Popular directions are given for the location and choice of soil for gardens, laying out and inclosing gardens, rotation of crops, and the construction and uses of cold frames and hot beds. A discussion is given of the selection and use of manures and fertilizers and preparation of soil, and directions for saving seed and the quantities required for planting. Definite directions are given for the culture of a large list of plants which are usually grown in gardens.

English varieties in America, W. N. CRAIG (*Amer. Gard., 18 (1897), No. 120, p. 259; reprinted in Fruitman's Guide, 3 (1897), No. 63, p. 11*).—Notes on the behavior of some English fruits and vegetables in America.

The edible wild plants of Savoy, A. CHALBERT (*Bul. Herb. Boissier, 5 (1897), No. 4, pp. 258-272*).

New celery culture, improved, M. JENKINS (*Farm and Fireside, 20 (1897), No. 13, p. 3; reprinted in Florida Farmer and Fruit Grower, n. ser., 9 (1897), No. 16, p. 242*).—Blanching celery by boarding up double rows set close together is recommended.

Forcing lettuce in pots (*New York State Sta. Rpt. 1895, pp. 326-342*).—Reprint from Bulletin 88 of the station (E. S. R., 7, p. 300).

Mushrooms as a greenhouse crop, S. A. BEACH (*New York State Sta. Rpt. 1895, pp. 331-342, pl. 1*).—Reprinted from Bulletin 88 of the station (E. S. R., 7, p. 301).

Notes on tomato breeding, F. W. RANE (*New Hampshire Sta. Bul. 42, pp. 24-26*).—Brief notes on the origin, history, and breeding of tomatoes.

Vegetable marrows, G. WYTHES (*Gard. Illus., 19 (1897), No. 946, p. 107, fig. 1*).—Notes on culture and varieties.

An economical top-dressing, F. V. DUTTON (*Gard. Chron., 3. ser., 21 (1897), No. 536, p. 217*).—Notes are given on the value of ammonium sulphate as a top-dressing for garden crops. It costs much less than sodium nitrate and has not the disadvantages of liquid manures for use on salad plants.

Basic slag as a garden manure, F. V. DUTTON (*Gard. Chron., 3. ser., 21 (1897), No. 539, pp. 266, 267*).

A fertilizer experiment with beans, R. OTTO (*Gartenflora, 46 (1897), No. 7, pp. 172, 173*).—Ten concentrated fertilizers were applied in solution to small plats of beans. Tables are given showing the production on each plat. No conclusions are drawn.

Promising new fruits, S. B. HEIGES (*U. S. Dept. Agr., Rpt. Pomologist, 1895, pp. 19-48, pls. 6*).—Descriptions are given of 99 varieties of apples, 13 of pears, 3 of apricots, 11 of cherries, 25 of peaches, 16 of plums, 2 of grapes, 4 of oranges, and 1 of pomelo.

Legumes in orchards (*California Fruit Grower, 20 (1897), No. 16, pp. 4, 5*).—An article taken from a letter by Professor Budd. The advantages of growing legumes in orchards are discussed and several examples of the practice are cited.

Cost and yield of drying fruit in Alameda County, G. H. HUDSON (*Pacific Rural Press, 53 (1897), No. 11, pp. 164, 165*).

Smith's improved method of grafting, R. SMITH (*Gard. Chron., 3. ser., 21 (1897), No. 535, p. 199, figs. 5*).—The method is described and illustrated. It is recommended for trees in exposed situations.

Principles of pruning, S. B. HEIGES (*U. S. Dept. Agr., Rpt. Pomologist, 1895, pp. 50-54*).—A popular article discussing some of the principles of plant growth as related to time and method of pruning. Root pruning for fruit and close root pruning are considered.

Fruit growing in Australia (*California Fruit Grower, 20 (1897), No. 16, p. 4*).—An article taken from the advance proof of the Yearbook of Australia. Statistics are given showing the extent of the fruit industry in various parts of Australia.

Olive growing in the San Joaquin (*Pacific Rural Press, 53 (1897), No. 15, pp. 229, 230*).—Directions for the culture of olive trees with a discussion of methods of pickling the fruit are given.

A few good pears (*Gard. Illus., 19 (1897), No. 946, p. 103, fig. 1*).—Notes on several varieties.

Prune growing in Ukiah Valley, E. W. KING (*Pacific Rural Press, 53 (1897), No. 11, pp. 165, 166*).—A consideration of soil, climate, culture, yield, methods of curing, etc., in regard to prune growing.

Small fruit culture, J. B. GILCHRIST (*U. S. Dept. Agr., Rpt. Pomologist, 1895, pp. 57–64*).—The writer gives his experience with the growing of strawberries, blackberries, and raspberries in Delaware. During 24 years accounts were kept of the expenditures and receipts for each crop. Summaries of these are given in the paper. The methods of culture used by the writer are given.

Second-crop strawberries, W. H. JENKINS (*Amer. Gard., 18 (1897), No. 123, p. 321*).

Productiveness of grapes as affected by self-fertilizing of their blossoms, S. A. BEACH (*New York State Sta. Rpt. 1895, pp. 320–325*).—A continuation of work reported in the Annual Reports of the station for 1892 and 1894 (E. S. R., 6, p. 46; 8, p. 608). The results of the investigations of 1895 are combined with results obtained previously and given in tabular form. Of the 145 varieties tested 31 are self-fertile, 55 are partly self-fertile and may be planted alone, 18 are partly self-fertile but should not be planted alone, and 41 are self-sterile.

Directions for care of young grapevines, II, W. CRADWICK (*Jamaica Bot. Dept. Bul., n. ser., 4 (1897), No. 1, pp. 7–9, figs. 6*).—Brief notes on propagation and pruning of grapes.

Report on the Murray and Hunter River vine districts, M. BLUNNO (*Agl. Gaz. N. S. Wales, 8 (1897), No. 1, pp. 38–43*).—A report on the status of viticulture in the Murray and Hunter River districts of Australia.

Précoce Caplat grape (*Jour. Agr. Prat., 61 (1897), I, No. 14, pp. 500–502, figs. 2*).—This grape, recently introduced from Japan, is described and figured and notes on its value are given.

Pot vines in small gardens (*Gard. Illus., 19 (1897), No. 944, p. 73*).—Directions for growing grapes in pots.

Treatment of frozen vines, L. DEGRULLY (*Prog. Agr. et Vit., 27 (1897), No. 16, p. 474*).

The use of Thomas slag for grapes on calcareous soils, J. JOSSINET (*Prog. Agr. et Vit., 27 (1897), No. 16, pp. 485–490*).

The almond in southwest Utah and southeast Nevada, T. J. JUDD (*U. S. Dept. Agr., Rpt. Pomologist, 1895, pp. 55–57*).—The writer gives his experience with the growing of almonds. Directions for their culture are given. An estimate is made of the profits to be derived from the business.

FORESTRY.

Notes on Western American conifers, J. G. LEMMON (*Gard. and Forest, 10 (1897), No. 481, pp. 183, 184*).—Notes are given of *Pinus scopulorum*, *Picea columbiana*, and *Abies shastensis*.

Picea polita, A. D. WEBSTER (*Gard. Chron., 3. ser., 21 (1897), No. 538, p. 251, fig. 1*).—Illustrated notes on this spruce tree.

Is the white pine doomed? R. DOUGLAS (*Gard. and Forest, 10 (1897), No. 481, pp. 480, 481*).—The author thinks this tree is not in immediate danger of extermination, as it seems to be able to seed itself very well.

Second growth white pine in Pennsylvania, A. K. MLODZIANSKY (*Gard. and Forest, 10 (1897), No. 480, pp. 172, 173*).

Pinus flexilis (*Gard. and Forest, 10 (1897), No. 479, p. 162, fig. 1*).—Illustrated notes are given of this pine, which is a native of the Rocky Mountain region. Its growth in the eastern part of the United States is poor, but it is said to do well in England.

Pinus balfouriana, C. A. PURPUS (*Forstl. naturw. Ztschr., 6 (1897), No. 4, pp. 172–174*).

Notes on the pine forests of southern and central Arizona, J. W. TOUMEY (*Gard. and Forest, 10 (1897), No. 478, pp. 152, 153*).

The species of Thuya, M. T. M[ASTERS] (*Gard. Chron., 3 ser., 21 (1897), Nos. 536, pp. 213, 214, figs. 5; 538, pp. 258, 259, figs. 2*).—Notes are given on *Thuya occidentalis*, *T. plicata*, and *T. japonica*. *T. plicata* is considered as a variety of *T. occidentalis* and not worthy of specific rank.

The red cedar, R. DOUGLAS (*Gard. and Forest, 10 (1897), No. 480, pp. 178, 179*).—Notes are given on the growth of this tree and its almost total failure in Illinois is recorded.

The red cedar (*Gard. and Forest, 10 (1897), No. 479, p. 168*).—Notes are given of this tree and its value for general planting in parks is pointed out.

Mixed plantations in British woodlands, A. C. FORBES (*Gard. Chron., 3. ser., 21 (1897), No. 540, p. 295*).

Ornamental and timber trees from seed (*Gard. Chron., 3. ser., 21 (1897), No. 538, pp. 247, 248*).—Notes are given of the propagation of the hornbeam, Spanish chestnut, hazel, horse-chestnut, walnut, hickory nut, plane tree, and the cherry.

Injury to trees, especially firs and pines, by birds, ALTUM (*Ztschr. Forst- u. Jagdw., 29 (1897), No. 4, pp. 224–230, fig. 1*).—Notes injury to trees by the very common destruction of leaf buds.

Forest management in Maine, A. CAREY (*Forester, 3 (1897), No. 5, pp. 60–64*).

Reasons for the establishment of forest reservations, B. E. FERNOW (*Forester, 3 (1897), No. 5, pp. 67, 68*).

Coöperative forestry, G. B. JAMES (*Forester, 3 (1897), No. 5, pp. 64–66*).

The influence of the removal of dead timber and varying amounts of light upon the growth of conifers, SCHWAPPACH (*Ztschr. Forst- u. Jagdw., 29 (1897), No. 4, pp. 201–224*).

Concerning the effect of the removal of dead wood upon forest growth, HEFELE (*Forstw. Centbl., 19 (1897), No. 4, pp. 193–199*).

Effect of lightning upon trees, R. HARTIG (*Forstl. naturw. Ztschr., 6 (1897), No. 4, pp. 145–165, figs. 33*).

Insurance against forest fires, DANCKELMANN (*Ztschr. Forst- u. Jagdw., 29 (1897), No. 4, pp. 230–237*).

Timber as a crop, J. D. LYMAN (*Agr. Massachusetts, 1896, pp. 22–24, pls. 2*).

SEEDS—WEEDS.

Electro-germination, A. S. KINNEY (*Massachusetts Hatch Sta. Bul. 43, pp. 32, figs. 12*).—After a brief review of the literature relating to the application of electricity to plant life, an account is given of a series of experiments conducted by the author in which the apparatus and methods employed are fully described.

The batteries used in the experiments were of two kinds, namely, four Leclanche cells, arranged in series, giving an electro-motive force of four or five volts; and two Samson cells, giving an electro-motive force of 2.88 volts.

In order to secure a larger variation in the forces obtained, a Du Bois-Reymond induction coil was used. Details of its construction are given. The methods of applying the stimulation are fully described, the moistened seed being placed in glass cylinders and the opening closed with copper disks to which the wires were attached.

Another method of applying the stimulation consisted of a glass funnel, in which were two copper disks, the upper one containing twelve holes. Between the two disks was a layer of moist sand in which the seed was planted and connections were made so the current would be passed through the whole apparatus. When this apparatus was used the seeds were first germinated in sawdust, and when the radicles had reached a length of 2 cm. they were transplanted to the sand.

For the germination experiments the apparatus is fully described. The plants which were investigated, to ascertain the effects of electricity in the germination and growth of radicles, were white mustard, rape, red clover, and barley. Twenty-five seeds of each kind were used in 64 lots. The details of the germination are tabulated. The effects of electricity on the germination and growth of radicles and hypocotyls of white mustard, rape, and red clover were investigated and the results tabulated. A comparison of different strengths of currents was also noted, as well as the effect of hourly treatment on the seeds of the horse bean and white lupine.

From the results of the experiments the author concludes that the application of certain strengths of electric current to seeds for short periods of time accelerates the process of germination. It was found at the end of 24 hours over 30 per cent more seeds were germinated of the treated lots than of the normal ones; and at the end of 48 hours there was about 20 per cent excess. The seeds receiving the electrical stimulation also gave a higher total percentage of germination than the other. The effect of electricity on the germination of seeds shows that there is a maximum, optimum, and minimum strength of current. The minimum strength of current at which acceleration was barely perceptible is a little less than one volt. The optimum is about three volts, and the maximum current, which was not definitely determined, is a comparatively high voltage.

The seeds subjected to but a single application lost the stimulating effect within a few hours; but when it was applied hourly to germinated seeds or growing plants it acted as a constant stimulus to their growth and development.

Variety tests of vegetable seeds, S. T. MAYNARD, J. H. PUTNAM, and S. W. FLETCHER (*Massachusetts Hatch Sta. Bul. 44, pp. 27–36*).—A report is given of a series of experiments conducted during the spring of 1896 to determine the vitality and purity of garden seeds as placed on the market. Fourteen kinds of vegetable seeds were purchased from 7 different seedsmen. The seed were divided into 2 lots, and 50 of each lot were placed in a seed tester and 50 were germinated on cheese cloth laid upon moist sand and covered with boards. The results of both tests were quite uniform, and the averages of the two are given in tabular form.

Field tests with vegetables, S. T. MAYNARD, J. H. PUTNAM, and S. W. FLETCHER (*Massachusetts Hatch Sta. Bul. 44, pp. 36–44*).—Field tests are reported of samples of seed of beets, lettuce, radishes, cabbages, celery, cucumbers, onions, parsnips, squashes, and tomatoes. The yield, quality, and relative worth of the different samples are given. The vitality of the seeds as shown by the tests is also given. The average percentages of vitality for the different seeds were as follows: Beets 77, cabbage 83, celery 70, cucumber 87, lettuce 97, onion 80, parsnip 71, radish 86, squash 81, and tomato 90.

Concerning the influence of light and chemical reagents on the germination of seed, A. J. J. VANDEVELDE (*Bot. Centbl., 69 (1897), No. 11, pp. 237–242*).

On the germination of almonds (*Rev. Gén. Bot., 9 (1897), No. 1, pp. 5–16*).

Danish seed control, 1871–'96, O. ROSTRUP (*Dansk Frökontrol. Copenhagen, 1896, pp. 83*).—A résumé of results and methods of Danish seed control published on the occasion of the twenty-fifth anniversary of the seed-control station in Copenhagen in 1896. A chapter is devoted to seed-control stations in foreign countries, a list of which is given, with year of establishment, name of director, etc.

DISEASES OF PLANTS.

Report of the mycologist, F. C. STEWART (*New York State Sta. Rpt. 1895, pp. 519–546, figs. 5*).—The following subjects are discussed in this report: (1) Two destructive lily diseases; (2) prevention of cabbage club root; (3) spraying tomatoes; (4) a disease of Norway maples; (5) witches' brooms on cherry trees; (6) observations on *Exobasidium peckii* and *Ramularia cylindriopsis;* (7) inoculation experiments with *Gymnosporangium macropus;* (8) "belted" apples and pears, and (9) a new leaf spot disease of apples.

The first lily disease described is said to have been known for several years, and has gradually grown worse until it threatens the complete destruction of the Easter lily industry. It is characterized as follows:

"Very soon after the leaves start they show blotches and streaks of light yellow. As the plant develops the yellow blotches are gradually replaced by numerous small, irregular, dead spots, giving the leaf the appearance of having been gnawed by insects. The flowers are spotted in the same manner. The whole plant presents a sickly, yellowish, rusty appearance, making it unsalable. In many cases the plants never flower; in others the flowers are distorted. The disease progresses very slowly. The bulb appears to be normal, but the tips of the feeding roots are found to be dead. If a healthy plant is knocked out of its pot, the ball of dirt appears white all over the outside with growing rootlets. A diseased plant similarly treated shows very few white rootlets."

The cause of the disease is obscure. Cultures made from leaves and buds develop various fungi and bacteria, but no one species appeared constantly. It is thought probable that when the cause of the disease is determined it will be found to be some organism living in the soil which prevents the roots from performing their proper function. Upon this hypothesis the author suggests the following treatment: (1) Never use soil in which lilies or other bulbous plants have ever been grown, and (2) previous to potting soak the bulbs for 1½ hours in a weak solution of corrosive sublimate.

The second lily disease mentioned is that known as the Bermuda lily disease, which attacks several varieties of lilies grown in the open air. The disease is caused by a parasitic fungus, *Botrytis* sp., and its characteristics as observed on its host are mentioned. Experiments with Bordeaux mixture seem to indicate that spraying at intervals of 10 days or 2 weeks, commencing with the appearance of the leaves and continuing until the flowers begin to open, will prevent attacks of the fungus. The spraying must be discontinued with the opening of the flowers, otherwise the fungicide will spot them.

Experiments conducted for the repression of club root of cabbage consisted in applying various quantities of lime to the soil. From a practical standpoint the application of about 90 bu. per acre seemed to give the best results. It is probable the lime should be applied 2 or 3 months before planting. When these applications have been made for 2 or 3 years in succession, it is very probable a smaller quantity will be required for the prevention of club root. The experiments show that the application of lime will prevent injury to cabbage by the club root if grown year after year on the same soil, yet such a practice is not to be recommended. A proper system of rotation should be adopted so that cabbages or other cruciferous plants should not follow each other oftener than once in 3 years.

An experiment is reported in which it appeared that the soil was infested by scattering the refuse and leaves over the ground. This practice should not be followed. Care must also be taken with the hotbed in growing seedling plants, and no soil should be used that has ever grown plants subject to club root. As an additional precaution a small quantity of air-slacked lime should be mixed with the soil in making the hotbed.

Experiments are reported upon spraying tomatoes for the prevention of "black rot," and the results seem to indicate that "black rot" is chiefly caused by *Macrosporium tomato*, and can probably be controlled by the Bordeaux mixture.

Beginning when the blossoms appear, plants should be sprayed at intervals of 10 days until the fruit begins to ripen. The disease is most severe in dry weather.

Another disease, which is due to *Cylindrosporium* sp., has been quite destructive to the foliage of the tomato, and for this applications of ammoniacal copper carbonate are recommended.

The author describes a disease of Norway maples which seems to affect the young plants, causing the destruction of many of them. The cause of the disease is a fungus, *Glœosporium apocryptum*, and the author says there is good reason for believing it may be prevented by applications of Bordeaux mixture.

Descriptions are given of witches' brooms on cherry trees which are caused by *Exoascus cerasi*. The appearance of the disease upon the foliage which later results in the formation of the well-known "witches' brooms" or "hexenbesen" is fully described. In case the disease shows a tendency to become troublesome, the cutting out and destruction of the "hexenbesen" before the spores come to maturity is recommended. This can be easily done, since the diseased twigs are said to be indicated by a red color at least a week before the spores mature.

Some notes are given on *Exobasidium peckii*, a well-known fungus which attacks many plants of the Ericaceæ, producing conspicuous enlargements of the branches, leaves, and inflorescence. While collecting material for the study of this fungus another was found on

Andromeda mariana. This species has been determined by C. H. Peck as a new species to which the name *Ramularia cylindriopsis* was given.

Notes are given of inoculation experiments conducted by the author and G. W. Carver with *Gymnosporangium macropus.* The life history of the fungus is discussed to a considerable extent. The experiments seem to indicate a great variation in the varieties of apples which are subject to attacks of this disease.

Under the title "belted" apples, the author describes a condition frequently met with in the past season in which apples and pears, otherwise perfect, were surrounded near the apex by a russet zone. In some cases the use of the Bordeaux mixture was considered to be the cause of this abnormal formation, but the author seems to think that it is caused by the freezing of dew collected upon the fruit while young.

A new leaf spot of apples, which appears in the form of circular brown dead spots about $\frac{1}{8}$ of an inch in diameter, is described. This species, although occurring frequently, has seldom been considered as very destructive. The cause of the disease is a new species of Phyllosticta to which the name *P. limitata* is given by C. H. Peck. The fungus is described as follows:

"Spots small, orbicular, commonly 1 to 3 lines broad, sometimes confluent, brown or reddish-brown, occasionally becoming gray or having a grayish center, often sterile, definitely limited and surrounded by a narrow, slightly elevated brown or blackish-brown margin, perithecia epiphyllous, few, minute, punctiform, black; spores elliptical, 0.0003 in. long, 0.00016 broad."

Three applications of Bordeaux mixture are recommended for keeping this spot in check.

Field experiments with potatoes for 1896, B. D. HALSTED (*New Jersey Stas. Bul. 120, pp. 19, figs. 4*).—In continuation of experiments reported in Bulletin 112 and the Annual Report of the station for 1895 (E. S. R., 7, p. 780; 8, p. 893), the author reports upon investigations on the prevention of potato scab by the use of various fungicides. In the experiments reported in this bulletin sulphur in varying amounts was much more extensively used than in any of the previous tests.

From the details of the experiment given it appears that the plats receiving sulphur at the rate of 300 lbs. per acre, in 1895, showed a very noticeable diminution in the amount of scab present, seeming to indicate a lasting fungicidal effect of the sulphur. Bordeaux mixture and ammoniacal copper carbonate were again tested and showed good results in checking the scab, but aside from these standard fungicides the results indicate that for soil treatment of scab sulphur surpasses any of the others.

Experiments were conducted in which cut seed was rolled in sulphur, another lot thoroughly dusted with acid phosphate, and a third with sulphur and acid phosphate. The cuttings were planted a week later, and two weeks from that time the plants had come up only from the pieces which had been rolled in sulphur and the check. These tests showed that the potatoes dried out much less when sulphur was used, and as a result a quicker and larger growth was obtained.

Other experiments showed that kainit has some fungicidal value, and it is thought probable that a mixture of kainit and sulphur at the rate of 300 lbs. each to the acre would give a valuable fungicide and fertilizer for use on scab-infested land.

A brief report is made on one plat of potatoes grown where previously badly club-rooted turnips had been produced. A large total weight of tubers was secured, but the percentage of scab was unusually high. In this case potatoes had not been planted on this soil for at least 6 years, and the crop was practically worthless.

Experiments with soil treatment for the prevention of diseases of sweet potatoes are reported. In these experiments sweet potatoes were grown for a third successive crop on the land, the object being to determine the lasting effect of the various substances which had been applied the previous years. The stand of plants was the lowest where lime was used at the rate of 1,000 bu. per acre and was but little better where 500 bu. of lime combined with 1,250 lbs. of sulphur was used. Lime alone at the rate of 250 bu. per acre reduced the stand of plants but little, and sulphur had no material effect in this respect. It appears from the results obtained that lime is not a preventive of soil rot and that of the various substances which have been tested, viz, lime, sulphur, manure, corrosive sublimate, kainit, and copper sulphate, sulphur is the best remedy for the disease.

An additional set of experiments is reported in which sulphur was applied in the row before setting the plants, in amounts ranging from 50 to 400 lbs. per acre. The tabulated results show that the yield of clean roots increased with the amount of sulphur used. The sulphur used in this series of experiments, which was quite widely conducted, cost a maximum rate of $4 per acre, and the author figures a net profit due to its use of from $23.50 to $63 per acre.

An experiment was conducted in which sulphur in amounts varying from 50 lbs. to 400 lbs. per acre was placed near the plants. It was mixed with several times its own bulk of soil and placed in the hole where the plant was to be set. While the yield in this experiment was not large, the amount of soil rot in the checks was very great, three check plats together not producing as many clean potatoes as one of the treated plats.

The author summarizes his experiments and suggests that for potato scab corrosive sublimate when added to the soil is effective, but the mere soaking of the seed in the solution is without effect. When the soil is infested, kainit is shown to have considerable fungicidal value, and sulphur has maintained its place as one of the best remedies for scab. Sulphur surpassed all others in checking soil rot and kainit stood second as worthy of further trial. Sulphur when applied with a fertilizer drill in the open row at the rate of 300 lbs. per acre gave excellent returns, but when mixed with a few times its bulk of soil and a little dropped in the hole it seemed to be too concentrated to be placed near the young plants.

For both Irish and sweet potato diseases experimented on, the suggestion has already been made that sulphur and kainit at the rate of about 300 lbs. per acre in the open row is a substantial remedy for scab and soil rot.

Corn smut, A. S. HITCHCOCK and J. B. S. NORTON (*Kansas Sta. Bul. 62, pp. 169–214, pls. 10*).—The object of this bulletin is to record observations and experiments made during the last 3 years upon the life history of the smut and upon conditions favoring the spread of the disease. The attempt was made to ascertain the amount of damage caused by smut and the number of clean and smutted stalks in 52 rows of corn. The figures show that the average weight of the corn on clean stalks was 193 gm. and on the smutted stalks 126 gm.—a loss of about one-third. The loss is confined chiefly to the grain, the stalks being nearly or quite as heavy in smutted as in sound corn. Out of 2,984 stalks, 724 stalks were more or less affected by the smut, and observations conducted in a number of fields showed a considerably higher percentage of affected plants, although 6 per cent is considered a fair average. Observations were made during the summers of 1894, 1895, and 1896 in numerous cornfields adjacent to the station. In all, about 200,000 plants were examined, and the results obtained in some of the most characteristic fields are given in tabular form.

An attempt was also made to ascertain the relative susceptibility of different varieties to the attacks of corn smut. Although considerable differences were noted, no variety was found to be smut proof. The differences are thought to be the result of accident rather than the power to resist disease.

Efforts were made to determine the relation between the amount of smut and the age of corn, and it became apparent that smut does not usually make its appearance on corn until it is 2 months old, and, other conditions being equal, all corn becomes equally smutted regardless of the time of planting.

A general description of smut and its life history is given, including descriptions of spores, germination, methods of culture, and germination in various nutrient solutions.

Infection experiments with the corn plant were conducted which seem to indicate that—

"(1) Infection may take place at any time of the season when the corn is growing, and does not depend so much on the time of the season as on the stage of development of the plant.

"(2) Infection may take place in any part of the plant where growing tissue is present, and at any time in its life, but scarcely ever before the plant has attained the height of 3 ft.

"(3) After the tissues are hardened the smut can not penetrate them, and consequently infection does not take place in older parts of the corn, but only in the growing tissues. This growing condition is found in the young leaves when the first smut appears in the field; later mostly at the junction of the leaf and sheath, where cells are present for a long time in a state of active growth, and consequently exposed longer to penetration by the germ tubes from the conidia; then in the flowers and young parts of the ear and tassel, while later in the season the only parts open to infection are the rudimentary ears, which develop after the larger ear at each joint on the lower part of the stalk.

"(4) The infection is probably through the conidia and not directly from the spores.

"(5) The period of incubation, or time between infection and the appearing of smut boils, is about 10 days.

"(6) It is probable that the early infections come from the spores of last year, which germinate on the ground at the first favorable weather in the spring, while the later and more abundant infections are from the new spores developed early in the season."

So far as the authors' observations go, they believe that smut is more abundant in dry seasons and in the drier localities. Soils recently manured or those near stables and barnyards are unusually favorable for the development of corn smut. The application of fungicides to the seed is without effect. Fresh manure, which is a favorable breeding ground for smut, should not be applied to corn ground, especially in damp soil, nor should corn be planted too close to sources of manure. By proper care in this respect and burning as much of the smut as possible in the field the disease could probably be kept within limits in which not more than 2 per cent damage would be done. The expense of doing anything more would be greater than the saving and is considered impracticable.

The synonymy of the fungus and an extensive bibliography are appended. Notes are also given on the occurrence of head smut of sorghum (*Ustilago reiliana*) on corn. As yet it has caused no serious damage.

Corn smut, A. D. SELBY and J. F. HICKMAN (*Ohio Sta. Bul. 78, pp. 92–95*).—Brief notes are given on the occurrence and cause of corn smut and recommendations for the prevention of the disease.

In 1895 two fields of corn were examined in order to ascertain the percentage of loss occasioned by smut, and it was found that 4.44 per cent of the stalks were smutted. At this rate there is an estimated loss amounting to $125,000 per annum for the whole State of Ohio.

Negative results were obtained in a series of experiments conducted in the treatment of seed with copper sulphate before planting. In the authors' opinion the best means for the prevention of corn smut is the destruction of the smut balls before they have had time to scatter their spores.

Raspberry anthracnose, S. A. BEACH and W. PADDOCK (*New York State Sta. Rpt. 1895, pp. 342–345*).—The report here given is in continuation of that given in Bulletin 41 of the station (E. S. R., 7, p. 38). Reviewing the work so far as given, it seems that Bordeaux mixture can be successfully used in combatting anthracnose, and in 1895 the rows sprayed with iron sulphate before the leaves had expanded produced a larger amount of fruit than any of the other rows. Further experimentation, however, is necessary to determine the value of this treatment. It is stated that the sulphuric-acid treatment, which has been recommended and which is preliminarily reported upon in the above-numbered bulletin, has proved to be too strong to be used successfully on raspberries. The treatment recommended by the author consists of 3 sprayings with Bordeaux mixture, beginning when the canes are about 6 inches tall, the other applications to follow at intervals of about 2 weeks. When the disease is severe, the cane should be cut out and removed from the field as soon as the fruiting season is over.

Modern plant pathological research, J. ERIKSSON (*K. landt. Akad. Handl. Tidskr., 36 (1897), pp. 96–99*).

The diseases and injuries of cultivated plants, I, J. RITZEMA BOS (*Ziekten en Beschadingingen der kultuurgewassen. Groningen: J. B. Wolters, 1897*).

Concerning the influence of age and temperature on the germination of fungus spores, C. WEHMER (*Centr. Bl. Bakt. u. Par., 2. Abt., 3 (1897), No. 4–5, pp. 104–108*).

Evolution of the spores of Pyrenomycetes, E. LAMBOTTI (*Rev. Mycol., 19 (1897), No. 74, pp. 48–52*).—Notes are given on the Sphæriaceæ.

Concerning the mycelium of Æcidium magellanicum, P. MAGNUS (*Ber. deut. bot. Gesell., 15 (1897), No. 2, pp. 148–152, pl. 1*).—The author figures and describes the mycelium of *Æcidium magellanicum*, which is parasitic on *Berberis vulgarus*, often causing hexenbesens in its host.

Concerning oriental plant galls, H. FOCKEN (*Rev. Gén. Bot., 9 (1897), No. 99, pp. 103–118, pls. 2, figs. 4*).

Recent investigations concerning the causes of potato rot, FRANK (*Deut. landw. Presse, 24 (1897), No. 14, pp. 113, 114*).

Investigations on some potato diseases in 1896, K. SAJO (*Ztschr. Pflanzenkrank., 7 (1897), No. 1, pp. 4–8*).

Potato diseases and their prevention, W. M. SCHOYEN (*Tidsskr. norske Landbr., 1896; abs. in Ztschr. Pflanzenkrank., 7 (1897), No. 1, p. 40*).

Bacterial gummosis of the sugar beet, SORAUER (*Blatter Rübenbau, 4 (1897), p. 81; abs. in Chem. Ztg., 21 (1897), No. 35, Repert., p. 102*).

Are the Enchytræidæ parasitic on the sugar beet? J. STOKLASA (*Centr. Bl. Bakt. u. Par., 2. Abt., 3 (1897), No. 4–5, pp. 108–110*).—A beet was planted in a glass dish in soil free from deleterious matter or organisms. Enchytræidæ washed in distilled water were then placed in the soil. A few days later an examination showed that they had attacked the beet root. Closer examination left no doubt as to their living upon the contents of cells of the plant, and that they are therefore to be considered as parasites of the beet.

On a supposed verminal disease of truffles, J. CHATIN (*Compt Rend. Acad. Sci. Paris, 124 (1897), No. 17, pp. 903–905*).—The nematodes, *Petodera strongyloides* and *Leptodera terricola*, commonly found in truffles, are shown not to cause the disease of these fungi. Their existence within the fungi is symbiotic. It is also noted that other nematodes are often confounded with *Tylenchus devastatrix* in the verminal disease of the onion, but that they are in reality harmless saprophytic forms that only resemble superficially the destructive worm.

On the injury of plants by asphalt vapors, P. SORAUER (*Ztschr. Pflanzenkrank., 7 (1897), No. 1, pp. 10–20*).

On the effect of the more common fungicides (*Ztschr. Pflanzenkrank., 7 (1897), No. 1, pp. 44–47*).

On the prevention of smut of barley and oats by soaking the seed, M. HOLLRUNG (*Landw. Jahrb., 26 (1897), No. 1, pp. 145–190*).

Treatment of common diseases and insects injurious to fruits and vegetables, S. A. BEACH and W. PADDOCK (*New York State Sta. Rpt. 1895, pp. 345–388, figs. 4*).—The subject here discussed is divided into (1) diseases and insects injurious to fruits; (2) diseases and insects injurious to vegetables; (3) diseases and insects injurious to nursery stock, and (4) fungicides and insecticides. The diseases and the insects are briefly and popularly described, and the remedy which has been found to be most efficient is recommended. In all cases the remedies have been tested, and detailed directions are given for their proper application. In the section of the paper devoted to fungicides and insecticides formulas for the preparation and directions for the application of the leading fungicides and insecticides are given.

ENTOMOLOGY.

The principal household insects of the United States, L. O. HOWARD, C. L. MARLATT, and F. H. CHITTENDEN (*U. S. Dept. Agr., Division of Entomology Bul. 4, n. ser., pp. 130, figs. 64*).—This is a popular compilation, containing numerous original observations. In nearly all cases the habits and life histories are described, original figures given, and the most appropriate remedies mentioned.

Mosquitoes and fleas, L. O. Howard (pp. 9–31).—Original observations are recorded relating to the mosquito (*Culex pungens*) and the dog flea (*Pulex serraticeps*). The eggs of the former insect, it is stated, are probably laid in the early morning hours, in numbers varying from 200 to 400. They are aggregated into a single layered, more or less boat-shaped, floating mass. The larvæ hatch in from 16 to 24 hours and escape into the water, but, unable to remain long beneath it, they gather at the surface of the water and project their small respiratory siphons into the air. The end of the body is never projected out of the water. The larval condition lasts 7 days and the pupal state 2 days, thus giving in all 10 days as the minimum generation for the species.

As remedies, pouring kerosene over the surface of the water in which they breed, agitating it, introducing salt or brackish water or small fish, and draining are recommended. Appended to the chapter is a list of the mosquitoes of the United States.

The generation of the dog flea is stated to be probably a fortnight in length. The food of the larvæ is believed to be the blood excrement of the adult and the dry vegetable accumulations in floor cracks, etc. The principal method of combating the pest is the preventive one of keeping the floors and carpets thoroughly clean. Pyrethrum, buhach, and benzine are not always effectual. A fairly successful method of attacking the adults[1] is to fasten sticky paper to the legs of a person and then have him walk back and forward over the floor.

The bedbug and conenose, C. L. Marlatt (pp. 32–42).—The bedbug (*Cimex lectularius*) and the blood-sucking conenose (*Conorhinus sanguisuga*), which in the South seems to have acquired a taste for human

[1] Insect Life, vol 7, p. 422.

blood, are discussed and remedies given. Thorough and daily inspection of beds and bedding form the best safeguard against the former insect. Benzine and the like should be used freely. Corrosive sublimate and hot water are effectual. Iron or brass bedsteads should be used instead of wooden ones. The conenose can be excluded from the house by screens.

House flies, centipedes, and other insects that are annoying rather than injurious, L. O. Howard and C. L. Marlatt (pp. 43–57).—Here are treated the common house fly (*Musca domestica*), stable fly (*Stomoxys calcitrans*), cluster fly (*Pollenia rudis*), another stable fly (*Cyrtoneura stabulans*), the so called blue bottle fly (*Calliphora erythrocephala*), green bottle fly (*Lucilia cæsar*), small house fly (*Homalomyia canicularis*), house centipede (*Scutigera forceps*), clover mite (*Bryobia pratensis*), house crickets (*Gryllus domesticus* and *G. assimilis*), field cricket (*G. luctuosus*), paper wasp (*Vespa germanica*), and bald faced hornet (*Vespa maculata*). The difference between the flies is pointed out and the observations and experiments of A. S. Packard, De Geer, and Bouché are noted as showing that horse manure is the favorite breeding place of the house fly. Continuous observations made upon the larvæ of flies breeding most freely in this substance indicate that they molt twice and that therefore there are 3 distinct larval stages. The periods of development were found to be nearly as follows: $\frac{1}{3}$ day for the egg from deposition to hatching; 1 day for the larva to the first molt; 1 day to the second molt; 3 days to pupation, and 5 days to the time of the emergence of the adult insect, making a total of about 10 days. It follows, therefore, that in the climate of Washington there is an abundance of time every summer for the development of 12 or 13 generations of flies. The number of eggs laid by an individual fly averages about 120.

Among the natural enemies of the fly are the house centipede and a fungus disease known as *Empusina muscæ*. The prompt gathering of horse manure in cities, and treating it with lime is recommended, along with general cleanliness, as the proper preventive. Under the head of the house centipede the authors figure and describe a young stage of the animal in which there are 9 pairs of perfect legs and as many as 3 pairs of leg buds. This is the youngest stage thus far described. An endeavor is made to remove the popular fear of the centipede and to show that it is a friend, aiding in keeping in check various household pests. The clover mite is included, because during its migrations in the fall it sometimes enters houses in enormous numbers. The pests may be disposed of by means of insect powders, the use of burning brimstone, spraying with benzine, etc. Entrance to the house may be prevented by spraying the sides of the house liberally with kerosene or by treating the lawns with kerosene emulsion. Crickets are noted at some length as ravaging curtains, garments, etc. They may be destroyed by the use of poisoned baits. The paper wasp should be excluded from the house by means of screens.

Species injurious to woolen goods, etc., *L. O. Howard and C. L. Marlatt* (pp. 58–69).—Here are treated the carpet beetle or buffalo moth (*Anthrenus scrophulariæ*), the black carpet beetle (*Attagenus piceus*), the clothes moth (*Tinea pellionella*, *Tineola biselliella*, and *Trichophaga tapetzella*). With regard to the carpet beetle, the author deprecates the practice of using carpets rather than rugs, and advises thorough house cleaning twice instead of once a year. The black carpet beetle is noted also as feeding upon vegetable products. The clothes moth is to be treated where it has gained access to clothing, garments, carpet, etc., by the use of benzine or naphtha or by sponging carefully with a weak solution of corrosive sublimate in alcohol, made not quite strong enough to leave a white stain. They can be prevented from attacking garments, etc., by storing the latter in cedar chests or wardrobes or by the use of insect repellants such as camphor or naphthalin cones or cedar chips, or, much better, by placing the garments in boxes and sealing up all cracks with strips of gummed wrapping paper.

Species injurious to wall paper, books, timbers, etc., *C. L. Marlatt* (pp. 70–83).—The white ant (*Termes flavipes*), the silver fish (*Lepisma saccharina*), the book louse (*Atropos divinatoria*), and the American spring tail (*Lepidocrytus americanus*) are here discussed. Relative to the termite it is noted that complete dryness in buildings is an important means of rendering them safe from attack and that libraries or buildings in which articles of value are stored should be surrounded on all sides by clear spaces and graveled or asphalted walks, since the insects can not withstand the exposure of traveling across them. Where colonies of the insect have been established they may sometimes be destroyed by an injection of kerosene into their retreat. The silver fish, which damages books and drugs and articles containing paste, may be disposed of by scattering pyrethrum in places frequented by it. It is stated that little damage is apt to occur except in moist situations or where objects are stored and not disturbed for a considerable length of time. The book lice have been extraordinarily abundant in barns and stables, sometimes causing considerable annoyance and damage by getting into cupboards, on window ledges, or library shelves, or especially among books and papers seldom used, where it feeds on any animal or vegetable matter obtainable.

The remedies recommended for them are the steaming of carpets and bedding, washing places with soapsuds, repapering or painting of walls and the application of benzine or gasolene freely to all retreats or to furniture which can not be otherwise cleaned; fumigation with brimstone or bisulphid of carbon will destroy many of the insects in rooms which can be tightly closed for several hours.

Cockroaches and house ants, *C. L. Marlatt* (pp. 84–99).—The cockroaches (*Periplaneta americana*, *P. orientalis*, *P. australasiæ*, and *Ectobia germanica*) are treated. Their injury to bookbinding, to stores of provisions, etc., are noted; and their habits and life history fully brought out. They may be combated by the use of poisons, by fumigation, and trapping. Their wariness makes them difficult to combat with poisoned baits, but they succumb to the effects of pyrethrum long enough to allow them to be swept up and burned. Small rooms may be made nearly air tight and fumigated with bisulphid of carbon or in the case of old houses with large fire places by following the German method of molding gunpowder into cones and lighting them in the empty fire places. The insects will be driven from their hiding places by the smoke of the burning powder and paralyzed, so that they may be readily gathered and destroyed. Traps of various forms have been used successfully. The egg parasite, *Evania appendigaster*, is noted as one of the natural enemies.

The house ants (*Monomorium pharaonis*, *M. minutum*, and *Tetramorium cæspitum*) can be destroyed, when their nests can be located in the house, by attracting them to small bits of sponge moistened with sweetened water and placed in situations where the ants are numerous. From time to time, when swarming with ants, the sponge fragments may be cast into hot water. A sirup made of borax and sugar dissolved in boiling water is also noted as a remedy. These methods are to be aided by the removal of other attractive substances from their neighborhood.

Some insects affecting cheese, hams, fruit, and vinegar, L. O. Howard (pp. 100–111).—Under this head are treated the cheese, ham, and flour mites (*Tyroglyphus longior* and *T. siro*) the cheese or ham skipper (*Piophila casei*), the red legged ham beetle (*Necrobia rufipes*), the larder beetle (*Dermestes lardarius*), the fruit or vinegar flies (*Drosophila ampelophila*, *D. amœna*, *D. funebris*, *D. graminum*, and *D. transversa*). The remedies recommended aside from cleanliness and watchfulness are for the cheese mite, fumigation with sulphur or washing with kerosene emulsion all places likely to harbor it. For the ham beetle, it is advised that hams be carefully packed in strong canvas impenetrable by the insect; for the larder beetle the use of bisulphid of carbon; for the vinegar flies, the use of good window screens and the perfect sealing of all canned fruit.

Insects affecting cereals and other dried foods, F. H. Chittenden (pp. 112–130).—Under this head the author treats the following pests: The flour beetles, viz, the confused flour beetle (*Tribolium confusum*), the rust red flour beetle (*Tribolium ferrugineum*), the broad horned flour beetle (*Echocerus cornatus*); the meal worms, viz, the yellow meal worm (*Tenebrio molitor*), the dark meal worm (*Tenebrio obscurus*), the Indian meal moth (*Plodia interpunctella*), the meal snout moth (*Pyralis farinalis*); the grain beetles, viz, the saw toothed grain beetle (*Silvanus surinamensis*), the cadelle (*Tenebroides mauritanicus*), the drug store beetle (*Sitodrepa panicea*), and its allies, the cigarette beetle (*Lasioderma serricorne*), the white marked spider beetle (*Ptinus fur*), the brown spider beetle (*P. brunneus*); and finally briefly mentions the granary weevil (*Calandra granaria*), the rice weevil (*C. oryza*), the pea weevil (*Bruchus pisorum*), the bean weevil (*B. obtectus*), the coffee bean weevil (*Aræcerus fasciculatus*), the black carpet beetle (*Attagenus piceus*), *Trogoderma tarsale*, and *Anthrenus verbasci*, the last a relative of the buffalo moth, a green beetle (*Cathartus advena*), *Læmophlœus pusillus*, and the Angoumois grain moth (*Sitotroga cereallella*), as occasionally found in vegetable stores.

As regards remedies, care in purchasing, storing in tight receptacles in cool dry rooms, heating affected stores in an oven to a temperature of 125° to 150° F., and the use of bisulphid of carbon are recommended.

The chinch bug and other destructive insects, F. M. WEBSTER (*Ohio Sta. Bul. 77, pp. 33–52, figs. 11*).—The author maps the distribution of this insect in Ohio for the years 1894–'96, and endeavors to account for the distributional phenomena shown. It is shown that during 1894 chinch bugs were distributed in a broad area extending nearly north and south in the western central portion of the State, embracing 18 counties. In the following year the band had changed by the insect disappearing from 5 counties and appearing in 12 new ones. Besides these 25 infested counties, the insect appeared scattered over the State in 21 other counties. The ravages of the insect were severe, and the autumn being a dry one it seemed likely the entire fall brood of the bugs must have gone through the winter in a healthy condition.

The spring of 1896 began with a moderate rainfall, except in the extreme southern portion of the State, where but few bugs had been reported during the previous year. About 750 packages of *Sporotrichum globuliferum* were distributed from the station, which evidently produced an effect upon the distribution of the insect during 1896. Sixteen counties were severely affected by the insect during this year. The insect was found in some localities in 35 other counties scattered over the State. The author is unable to account for the immunity of Clarke and Montgomery counties from the attacks of the insect. Neither map elevation nor meteorological data furnish any clew whatever to the problem, while the continued ravages of the pest in Ashtabula, Trumble, Mahoning, and Portage counties are even more difficult of explanation.

With reference to his experience with the fungus *Sporotrichum globuliferum* as an insecticide, the author says:

"While the practical value of this fungus has, in past years, probably been overestimated, it is to be regretted that there is at present a tendency to rush to the opposite extreme. Statements to the effect that it is of no value to the farmer, or that artificial introduction is useless, as when the conditions are favorable it will appear in a natural manner and do its work are, to say the least, ill-advised and true only under certain conditions. It is worthless to the farmer during a period of drought or when the bugs are scattered, but it is practical and effective under conditions the reverse of these. It will sometimes appear in the fields in a perfectly natural manner, but this is uncertain, and we have here only one of many instances where science can and does facilitate and accelerate the usually slow mechanism of nature."

The author does not seem to consider the outlook for 1897 bad, provided there be drenching rains during the breeding season of the insect; but, inasmuch as the experiences of the past 3 years have shown him that no one can tell where the trouble may break out, he thinks it is dvisable to burn over the roadsides, fence corners, and leaves in the woods where the insects hibernate, and in the spring sow as early as possible small plats of millet in damp places about fields to serve as a bait to females and to induce them to deposit eggs there rather than in the wheat fields.

Some destructive insects that need to be watched for in Ohio.—The author describes in a popular manner 4 destructive foreign insects, namely, the sinuate pear borer (*Agrilus sinuatus*), the pear midge (*Diplosis pyrivora*), the wood leopard moth (*Zeuzera pyrina*), and the cabbage curculio (*Ceutorhynchus rapæ*). The last is already found in Ohio.

Notes on injurious insects, H. OSBORN (*Iowa Sta. Bul. 33, pp. 594–605, fig. 5*).—These notes concern the hickory bark beetle (*Scolytus 4-spinosus*), the chicken mite (*Dermanyssus gallinæ*), the blister beetle (*Epicauta pennsylvanica*), the army worm (*Leucania unipuncta*), a new pest of potatoes (*Empoasca mali*), the Hessian fly, and the sheep foot louse (*Hæmatopinus pedalis*), a new sheep pest.

Remedies are noted and very brief descriptions of the pests given. London purple, used in the form of a spray, is recommended against the hickory bark beetle, cutworms, the blister beetle, and the army worm. Burning off stubble is recommended as a means of disposing of the Hessian fly. For the mites and lice the use of kerosene emulsion is recommended. Experiments were performed with London purple to determine whether a mixture of this substance with flour at the rate of 1 part to 15 parts of the flour, or a spraying solution made in the proportions of 1 lb. to 200 gal. of water, is preferable. Ten rows of mangel-wurzels were dusted with the dry powder in the morning while the dew was on the leaves, but the day being a windy one the application of the powder was discontinued, although the experiment was carried far enough to show that the treatment might be effective. This method, however, has the disadvantage of being much more expensive than spraying on account of the time and material required.

Spraying gave excellent results and in no way injured the leaves, while it so effectually destroyed the insects that within a few days hardly a live one could be found. An ordinary hand-spray pump and a 50-gal. barrel were used, which required one man to do the pumping and another to handle the nozzle. For the 4 or 5 acres sprayed 200 gal. of the solution were required; and counting London purple at 8 cts. per pound the cost of the material per acre was less than 2 cts. But including the labor the cost amounted to about $1 per acre.

The army worm was reported this season to the station for the first time. If the worms were present before, they were seldom so abundant as to attract attention. The damage they did this year was one of the notable events of the season. Nearly every county seemed to be affected.

Empoasca mali, which has hitherto been known to affect the apple, was found at Ames upon the potato, and, judging from the damage it did there, the author thinks there is danger of its becoming a serious potato pest. The injury to the vines was so threatening that immediate steps were taken to apply a spray of kerosene emulsion made in the usual proportions. A four-nozzle spraying outfit was affixed to the rear end of a wagon so that four rows of vines could be covered at once. In front of the nozzles and suspended from the rear of the wagons a narrow board was attached so that it would brush the tops of the vines and cause the insects to fly into the spray, while at the same time exposing the larvæ adhering to the stems and under sides of the leaves. A large percentage of the insects were killed by the first application, and the second one, made within a few days, so reduced their numbers that they required no further attention.

The harlequin cabbage bug and the melon plant louse, J. B. SMITH (*New Jersey Stas. Bul. 121, pp. 14, fig. 1*).—The author gives a very popular account of these two insects (*Murgantia histrionica* and *Aphis gossypii*). Their appearance is briefly discussed, and the most effective remedial and preventive measures noted. A few notes are added on bisulphid of carbon, in which it is suggested that a grade known as "fuma bisulphid" is cheaper and much more effective than the form ordinarily employed.

Relative to remedial and preventive measures the author lays considerable stress upon very clean cultivation, and thinks it advisable for much of the rubbish ordinarily destroyed to be gathered and left in heaps in which insects may undertake to hibernate. In the winter these heaps may be burned, and probably by far the greater portion of insects hibernating on the farm may be thus destroyed.

Against the harlequin cabbage bug the ordinary remedies are useless, either because they can not be made to reach the insect, or if they do, they must be employed in such degrees of concentration as to be injurious to the plant. Before planting the cabbages it is advisable to raise a trap crop of radishes or mustard.

The melon lice may be destroyed when the plants are young by covering the latter with a paper or cloth dome-shaped cover, under which is placed a little bisulphid of carbon. It is very important to destroy the first broods of the insect, for if the season be a dry one, they may increase and spread beyond control. Other remedies recommended are whale-oil soap, used at the rate of 1 lb. to 4 gal. of water, kerosene emulsion diluted 10 times, and ice-cold water.

On the life history of Brachytarsus alternatus, A. L. QUAINTANCE (*Ent. News, 8 (1897), No. 1, pp. 1–3, pls. 1*).—While carrying on studies on insects injurious to stored grain, this anthribid beetle was found to be abundant in certain localities in Florida, feeding both as larva and adult on stored corn, cowpeas, and English peas.

The early stages and food habits of this beetle do not coincide with the idea that the larvæ of this genus are parasitic on scale insects.

Adult specimens were placed in different glass jars and supplied with uninfested corn or cowpeas. Somewhat later eggs were found in the débris and excrement at the bottom of the jar by use of iodin. They were found on the base of kernels of shelled corn. Although oviposition was not observed, it appears that in the case of corn in the ear the eggs are placed down in the crevices between the kernels. The larvæ enter the kernels by eating a very small hole through the softer portion at the base and thence eat upward toward the top. But one larva occupies a single kernel.

The life cycle is of about six weeks' duration, although some cases were observed in which it was seven.

The blueberry spanworm (Diastictis inceptaria) and the bumble flower beetle (Euphoria inda), M. V. SLINGERLAND (*Canadian Ent., 29 (1897), No. 3, pp. 49–53, pl. 1*).—A few notes on the ravages of the blueberry spanworm (*Diastictis inceptaria*) and the larval history of the bumble flower beetle (*Euphoria inda*) are given. Some larvæ of the latter insect were received June 19 and July 18, 1896, and placed in cages in rotting sod and manure. The larvæ quickly buried themselves, and on July 28 were found to have changed to pupæ in earthen cocoons of a somewhat peculiar and definite shape, evidently made by their rolling and twisting about and then cementing together the particles of earth around them.

On August 13 the first adult beetles appeared. They continued to appear until September 10, but most of them emerged in August. Since the larvæ of this insect are found in rotting manure and have never been observed to feed upon roots, the author thinks it injurious only in the adult state.

The best remedy against beetles appears to be hand picking.

Report of the entomologists, V. H. LOWE and F. A. SIRRINE (*New York State Sta. Rpt. 1895, pp. 549–633, pls. 11, figs. 16*).—The work done during the season is reported in different parts of the report under various headings.

The oak scale at Geneva, New York (pp. 550, 551).—This insect (*Asterodiaspis quercicola*) is reported as having been very abundant on oak trees at Geneva during 1895, the author's attention being first called to it on a row of white oak trees on one of the streets of the village. Some of the trees were nearly leafless and apparently dying. They were badly infested from top to bottom. In other cases the lower limbs had not produced leaves and some of the smaller branches were dead.

The white marked tussock moth (Orgyia leucostigma) in western New York (pp. 552, 553).—Larvæ of this insect were very numerous in the western part of the State, causing considerable injury, especially in Yates and Ontario counties. One fruit grower reported that 25 per cent of his apple crop had been ruined. The injury was done not only by the caterpillars feeding upon the foliage of the trees, but also upon the apples, causing them to become withered and deformed. The author points out the distinctive characteristics of the insect and then proceeds to consider the remedies. Jarring the trees and spraying with arsenates are recommended.

The cottonwood leaf beetle at Liverpool, New York (pp. 554, 558).—In 1894 a report was received that the basket-willow industry in the vicinity of this town was suffering serious injury from this beetle. One willow grower, whose farm yielded him usually $2,000 worth of willows annually, reported a yield of only $200 worth in 1894, attributed partly to the dry weather of the previous year, but mostly to injuries from this beetle.

The insects are first noticed from May 20 to June 1, or at a time when the willows are getting a start for the summer's growth. They feed on the leaves to a certain extent, but seem to prefer the tender growth of the tips of the willows. This sort of injury causes the willow to throw out branches, which ruin it for market purposes.

As remedies, London purple, Paris green, and arsenate of lead, as well as catching and killing the beetles and larvæ, are recommended. One lb. of Paris green to 150 gal. of water is thought sufficient for this insect. To prevent burning the foliage by the free arsenic in the water, it is recommended that lime in the form of milk of lime be added to the mixture. To cause the Paris green to adhere to the smooth surface of the willow leaf, the addition of glucose or molasses at the rate of 1 qt. to 150 gal. of water is thought advisable. This insect was also found in Powell County, where it was attacking Carolina poplars and threatening their ruin. At the same place Norway poplars were also attacked.

The corn worm (*Heliothis armigera*) (pp. 559–565).—A popular account is given of this insect. The author mentions the subject of its distribution, its destructiveness in the United States; considers the life history and habits of the insect as a corn and tomato pest; briefly describes the moth and the appearance of the infested ears of corn, and discusses remedies. Fall plowing is highly recommended as the most practical remedy in the North. Paris green, London purple, and kerosene emulsion are recommended as remedies that have been tested. Trap lights, attracting and destroying moths by poisoned sweets, are mentioned as doubtful remedial measures.

The striped cucumber beetle (*Diabrotica vittata*) (pp. 566–573).—This insect is said to be much dreaded in some portions of the State where cucumbers, melons, and squashes are extensively grown—as, for example, on Long Island, where these crops are very important. A letter from Jerico, Long Island, is quoted as follows:

"This beetle is quite discouraging to the growers of early pickles or cucumbers. Half-grown vines as they begin to produce fruit die here and there, and in most pickle fields the vines also appear to be injured as a result of an attack upon the roots. This last evil threatens to ruin the industry. It has moved the western limit of successful pickle growing from the immediate vicinity of Jamaica to Westbury in 25 years (a distance of over $11\frac{1}{2}$ miles)."

The insect is briefly described and its life history and methods of treatment discussed. The most successful remedies noted are dry wood ashes, air-slacked lime, Paris green mixed with plaster, pyrethrum, and tobacco dust.

The New York plum lecanium (*Lecanium*, sp.) (pp. 574–595).—This insect was first noticed in injurious numbers in the western portion of the State early in the season of 1894. It was found most abundant upon plum trees. Recent literature concerning this insect in New York, its winter appearance, distribution in the United States, its food plants, its injuries to trees and fruit, its life history and habits, enemies, and experiments with remedies, are noted.

As to the specific name of the scale, 2 names (*cerasifex* and *juglandis*, Bouché) were given by 2 different entomologists to whom the same scale was sent. It is referred to as *prunastri* Fonc. by another entomologist (E. S. R., 7, p. 514).

In the experiments the attempt was made to determine the relative value of different strengths of kerosene emulsion, made according to the usual formula, when applied in winter when the young scales were hibernating, applied in the spring while the scales were growing, and applied on newly hatched scales. As a result of these winter experiments, in which the emulsion was used in strengths ranging from 1 in 4 to 1 in 12, it was found that soon after the application the scales began to turn to a light yellowish-brown color, to shrivel up, and drop off easily. This condition was most noticeable where the emulsion had been used diluted with 4 to 6 parts of water. In December it was estimated that 90 per cent of the insects had been killed by the emulsion employed in these strengths. In 2 spring experiments the emulsion was diluted with 15 and with 9 parts of water. The weaker solution had no effect, and very slight effects, if any, followed the application of the stronger solution. In the summer, in one experiment kerosene emulsion diluted with 6 parts of water was employed; in the winter a resin wash made according to directions given in Farmers' Bulletin No. 19, p. 13, was employed. In September, when the trees were examined, it was found that both solutions had killed about 80 per cent of the scales.

The authors conclude that inasmuch as it costs from 0.2 to 0.7 cent per tree, the kerosene emulsion is the cheapest and most practical remedy, and that the best time for spraying is during the winter, when a solution not weaker than 1 in 4 or 1 in 6 should be employed. For spring spraying, the solution should not be weaker than 1 in 9.

The use of a power sprayer is not thought advisable.

Preliminary reports of experiments with the potato flea beetle (*Crepidodera cucumeris*) (pp. 596, 597).—Eight experiments were made in which different mixtures and strengths of Paris green, a solution of Paris green and whale oil soap, a soap pyrethrum solution, a solution of 1 per cent of lysol, a tobacco decoction, and Bordeaux mixture were employed. The experiments were discontinued before final results could be obtained.

Notes of the season (pp. 599–604).—The cabbage root maggot, the cabbage louse, and the corn worm did less damage during 1895 than the previous season, while the damage done by the Colorado potato beetle and the European cabbage worm remained about the same as during the previous year. Cutworms caused a great amount of damage. The cabbage louse (*Aphis brassicæ*) was noticeably absent in Long Island, while the green fly (*Rhopalosiphum dianthi*) occurred in destructive numbers. The apple louse (*Aphis mali*), the green fly (*Rhopalosiphum dianthi*), and several other species are noted as more or less common. The seed stalk weevil (*Ceutorhynchus seriesetosus*) of kale, cabbage, and turnip did considerable damage in Long Island in the seed-growing sections, but was not to be found at the west end of the Island. The tomato worm, in many places in Queen's County, entirely stripped the tomato vines. They were severely attacked by parasites (*Apanteles congregatus*), and probably not more than 10 per cent of the worms reached maturity.

Notes on remedies for the pernicious and other scale insects (pp. 605–617).—The pernicious scale has been traced to nearly all parts of Long Island, and to trees obtained either from infested Long Island or New Jersey nurseries. Very extensive experiments are recorded in which kerosene emulsion diluted with 2 and 3 parts of water, a resin wash, a lime-sulphur-salt wash, a saturated solution of crude potash, and a fish-oil soap mixture were employed. Summer washes were given as severe tests as possible, the principal object being to determine which would kill the largest number of migrating young. A secondary object was to test the effect of a crude petroleum emulsion on adult scales. The results obtained showed that 80 per cent of all young scales that issued during the period of treatment were killed by the crude petroleum emulsion. Few of the plants retained their leaves. In those experiments in which kerosene emulsion was employed nearly all retained their leaves, as well as many live young scales, only 50 per cent being killed. Approximately, all the exposed young were killed by both emulsions. The linseed and whale-oil soap treatment and the gas treatment are also mentioned, as well as the plan of dipping stock.

The other scales noted are the oyster shell bark louse and the "euonymus scale" (*Chionaspis euonymi*). From the various experiments recorded the author concludes that the best results are to be obtained by applying the winter washes during the fall and that whale-oil soap is the best remedy for general use. In case of nursery stock it is important to remove the dirt from about the crown of the trees and apply the wash thoroughly from buds to roots in the fall or early spring. But the gas treatment is considered the simplest and cheapest, and, so far as tested on Long Island, has given as good results as any of the other remedies. The oyster shell bark louse and the euonymus scale can be controlled by washes. Linseed oil is not a safe remedy at any season on peach trees and should be carefully tested on all trees having a thin bark before it is used as a remedy. Kerosene emulsion diluted with 3 parts of water is concluded to be unsafe and uncertain. Crude petroleum emulsion is both more expensive and more dangerous than kerosene emulsion.

The bramble flea louse (*Trioza tripunctata*) (pp. 619–623).—This insect is considered historically and biologically. Gathering the curled leaves or cutting off the heads of canes is recommended as the only practical remedy. It is suggested that frequent applications of a weak kerosene emulsion, when the curling of the leaves is first noted, will considerably reduce the amount of injury.

The spinach leaf maggot or miner (*Pegomyia vicina*) (pp. 621–633).—This insect receives the same treatment as the last. The only remedy recommended aside from the destruction of the infected plants is a cultural method of destroying all lamb's-quarters or pig weeds throughout the summer and cutting the weeds in neglected corners, hedges, fences, roadsides, driveways, and turnrows, and keeping such places in grass, clover, rye, or oats. The pupæ may be gotten rid of by deep plowing.

The increase of the San José scale in Delaware during 1896, G. H. POWELL (*Delaware Sta. Bul. 33, pp. 10*).—The increase of the San José scale during the past year is mentioned and some of the causes pointed out. From a known number of 50 trees infested in a previous year the scale insect has spread until more than 1,000 trees are known to be infested at the present time. The cause of this increase is attributed to the rapid multiplication of insects, the indifference of some fruit growers to it, the inefficiency of some of the washes used, the impossibility of determining with definiteness every affected tree, and the absence of laws enforcing methods of eradication. The author considers that it is impossible to exterminate this scale by spraying, but it may be held in check by this means. Laws are needed in the State to prevent the introduction of infested stock, and the compensation to the owner of destroyed orchards is considered as the most economic policy for the State to pursue at the present time.

Spring feeding (*Jour. Hort., 49 (1897), No. 2534, p. 351*).—In feeding bees it is advised that the food be slightly warmed when beginning feeding, and that 1 pt. be fed at a time as fast as the bees will take it, or at the rate of 3½ oz. per day.

Concerning hydromel, R. PINZOT (*L'Apiculteur, 41 (1897), No. 2, pp. 60–62*).—The methods of making this substance are discussed.

The pear gall gnat, G. ABBEY (*Jour. Hort., 49 (1897), No. 2540, pp. 486, 487, fig. 1*).—After speaking of the synonyms of *Diplosus pyrivora* and of its introduction into Connecticut, probably from England in 1877, and its subsequent spread to neighboring States, the insect is described, and also the manner and the effects of its attack upon the pear. When the flies appear they may be caught on traps made of strips of tin, 3 by 12 in. in size, smeared with a mixture of resin and sweet oil; or by spraying just before the blossoms open with soluble petroleum; or by the use of the odors of formalin or spidacide. When the petals drop, an insecticide may be used. Other precautionary methods recommended are the removal of the infected part and dressing the ground beneath the tree with kainit at the rate of 1,000 lbs. per acre or 7 oz. per sq. yd. after a rain.

The woolly aphis or American blight (*Jour. Hort., 49 (1897), No. 2534, pp. 347, 348; repr. from Bd. Agr.* [*London*], *Leaflet 34*).—The insect is described, and the following noted as remedies: Freeing trees from moss, lichens, etc., covering them with powdered lime, burning all young trees, and washing with a wash composed of 1 pt. soft soap, 3 qt. paraffine oil in 25 gal. water late in autumn or winter; or in case of infected trees, applying a wash of 5 to 6 pt. of soft soap and 5 gal. paraffine oil in 100 gal. water.

The onion fly (Phorbia cepetorum), (*Jour. Hort., 49 (1897), No. 2535, p. 369, fig. 1; repr. from Bd. Agr.* [*London*], *Leaflet, pp. 31*).—The pest is described and the common remedies given.

Pests of vegetable crops and their treatment, G. McCarthy (*North Carolina Sta. Bul. 132, pp. 326–336*).—After a brief introduction, several pieces of apparatus, sprayers, and bellows for applying remedies, are described. Formulas for fungicides, insecticides, and rat, mole, and mice poisons are given. Under the head of "Plants and their parasites" the author gives briefly the insect and fungus parasites of asparagus, bean, beet, cabbage, carrot, collard, celery, sweet corn, cucumber, eggplant, herbs, horseradish, kale, kohl-rabi, leek, lettuce, melons, mushrooms, okra, onion, parsley, parsnip, pea, pepper, potatoes (Irish and sweet), radish, rhubarb, salsify, spinach, squash, tomato, and turnip. Remedies are briefly noted in each case.

The insects of the meadows, V. Mayet (*Prog. Agr. et Vit., 14 (1897), No. 3, pp. 81–84*).—The pea beetle (*Apion pisi*), clover beetle (*A. apricans*), clover moth (*Bombyx trifolii*), and the buprestid (*Sphenoptera gemellata*) are treated.

The threatening thrips (*California Fruit Grower, 20 (1897), No. 17, p. 3*).—Thrips is reported as doing great damage in Fresno County to raisin vineyards.

Agricultural and entomological report, 1895, P. H. Foulkes (*Jour. Reading* [*England*] *Univ. Extension Coll. Suppl., pp. 33–36*).—Reports on damage done by the turnip flea (*Haltica nemorum*), frit fly (*Oscinis frit*), crane fly (*Tipula oleracea*), rose chafer (*Phyllopertha horticola*), turnip gall weevil (*Ceutorhynchus sulcicollis*), mangel fly (*Anthomyia betæ*), black slug (*Arion ater*), white fly (*Aleyrodes vaporiorum*), currant gall mite (*Phytoptus ribis*), and parsnip fly (*Tephrites onopordinis*). Among the methods of prevention mentioned are applications of nitrate of soda for the mangel fly, fresh gas lime for the turnip gall weevil, and manure for the frit fly; and the planting of trap (mustard) plants for the turnip fly.

Contribution to the knowledge of the genus Scleropterus Schönh., A. Otto (*Verhandl. k. k. zool.-bot. Gesell. Wien, 47 (1897), No. 2, pp. 65–69*).—The new subgenus, Scleropteridius, and the new species, *Scleropteridius fallax, S. monticola,* and *S. austriacus,* are described.

Buprestidæ collected from tobacco by M. A. Gronvelle, C. Kerrmans (*Ann. Soc. Ent. France, 55 (1896), No. 1, pp. 138–176*).—This forms part II and III of the author's paper and takes up the forms found in Sumatra and Brazil. Twenty-two forms belonging to the genera Melibœus, Sambus, Agrilus, Aphanisticus, Endelus, Trachys, and Pachyschelus were found in the former country, and 55 forms belonging to the genera Chrysobothris, Micrasta, Paragrilus, Agrilus, Pachyschelus, Brachys, Lius, and Leiopleura in Brazil.

Revision of the Coleoptera of the family Bostrychidæ, P. Lesne (*Ann. Soc. Ent. France, 55 (1896), No. 1, pp. 95–127, pls. 2, figs. 10*).

Structure of Gammasidæ, F. Neri (*Atti Soc. Tosc. Sci. Nat., 10 (1896), pp. 126–138; abs. in Jour. Roy. Micros. Soc.* [*London*], *1897, No. 2, p. 122*).—The structure of *Dermanyssus gallinæ* is described.

Adulterated Paris green, F. W. Morse (*New Hampshire Sta. Bul. 43, pp. 29, 30*).—An analysis of what was claimed to be "pure Paris green" showed the presence of only 30 per cent of arsenic trioxid and 43.3 per cent of substances insoluble in hydrochloric acid, indicating that the material was a mixture of about equal parts of Paris green and earthy matter.

Spraying for the destruction of insect and fungus growths, S. T. MAYNARD, J. H. PUTNAM, and S. W. FLETCHER (*Massachusetts Hatch Sta. Bul. 44, pp. 45–48*).—A spraying calendar is given, with formulas for insecticides and fungicides, with directions for their application.

Important insecticides, C. L. MARLATT (*U. S. Dept. Agr., Farmers' Bul. 19, pp. 24, rev. ed.*).—The first edition of this bulletin was noted in E. S. R., 6, p. 315. In this edition additional data on bisulphid of carbon have been given. The use of arsenicals in connection with other fungicides, such as copper sulphate and eau celeste, or iron chlorid solution, is cautioned against. Brief notes on poisoned bait are added. A mixture of 1 lb. of white arsenic, 1 of sugar, and 6 of bran is recommended for locusts. Relative to the advisability of the rotation of crops, it is noted that the owner of a large farm in Indiana saved $10,000 by following corn with oats where the corn root worm had been very injurious the year previous.

Arsenite of soda for spraying, C. C. ABBE (*Amer. Agr.* (*middle ed.*), *59* (*1897*), *No. 25, p. 736*).—Prefers this to Paris green, as being cheaper and easily procured or made, and because the spraying mixture remains uniform in strength. For 800 gal. of spraying mixture 2 lbs. of white arsenic and 8 lbs. of sal soda are boiled in 2 gal. of water for about 15 minutes. This forms a stock solution. The spraying mixture may be be made by slacking 2 lbs. of lime in 40 gal. of water and adding 1 pt. of the stock solution.

Arsenate of lead on potatoes, F. C. MOULTON (*Amer. Agr.* (*middle ed.*), *59* (*1897*), *No. 23, p. 686*).—The author favors this substance in preference to Paris green, since it is cheaper by about 10 cts. per pound; since it may be used in very strong solution without injury to the foliage, viz, 1 lb. to 2 gal. of water; and since it remains on the foliage throughout the season instead of being washed off by the first rain. The author explains that the theoretical proportions of the acetate of lead and arsenate of soda used in forming the arsenate of lead is 70.07 per cent of the former and 29.23 per cent of the latter; but he adds that a slight excess of acetate of lead is advisable as a protection against injury to the foliage. His method is to mix 11 oz. of acetate of lead and 4 oz. of arsenate of soda and place in a paper bag. When ready to spray, several bags are emptied into the water, adding 2 qt. of glucose or molasses to each 150 gal. of water.

Remedy against the onion maggot, J. B. SMITH (*Amer. Agr.* (*middle ed.*), *59* (*1897*), *No. 15, p. 455*).—Kainit was applied broadcast at the rate of 500 to 600 lbs. per acre after turning the earth away from the onion rows, to be turned back after the application, in the rows at the time of setting, or as a top-dressing. In the first experiment all diseased onions were first removed and destroyed.

Destruction of the beet sylph, MARÉCHAL (*L'Engrais, 12* (*1897*), *No. 24, p. 565*).

FOODS—ANIMAL PRODUCTION.

Old vs. new-process oil meal, J. WILSON and C. F. CURTISS (*Iowa Sta. Bul. 33, pp. 591–593*).—A feeding test which lasted 4 months was made with 9 cattle divided into 3 lots. Lots 1 and 2 each consisted of 2 cows and a yearling steer, and lot 3 of a cow, a bull, and a yearling steer. Lots 1 and 2 were as near alike as possible. The cows in lots 1 and 2 were bred before the trial began to ascertain whether new-process meal would in any way interfere with the health of the cows during the period of gestation. During the first 2 months of the test lots 1 and 3 were fed old-process meal, and during the last 2 months new-process meal. With lot 2 the conditions were reversed.

All the lots were given the same amounts of corn fodder and corn on the ear in addition to the linseed meal. The amount of meal fed was gradually increased until the yearlings were fed 4 lbs. per day and the other cattle 5 lbs. The composition of the old and new-process linseed meal, the amounts of food consumed, and the gains made are given in tabular form. The average daily gain of all the cattle was 1.39 lbs. The total gain on old-process meal was 697 lbs., and on new-process meal 783 lbs.

"The health of all the cattle was good during the experiment. The pregnant cows were not injured in any perceptible manner by eating either of the meals. From indications had in this trial, new-process oil meal is as safe a by-product to feed with other fodders as old-process oil meal.

"The analyses of the two meals are substantially alike in protein, the old process being richer in fat."

Report upon the value of a new corn product, H. J. PATTERSON (*Maryland Sta. Bul. 43, pp. 165–185*).—In the construction of war vessels it is proposed to use corn pith as a packing between the inner and outer shells. In preparing the pith for this purpose the blades and husks are removed from the stalks and the stalks cut up into small pieces. The pith is then removed, and the remainder of the stalk is ground up into meal, "which in general appearance resembles coarse bran, dried malt sprouts, or brewers' grain. This ground material is termed 'the new corn product' in the following experiments."

A number of experiments were made with 4 steers to determine the digestibility of the new corn product as compared with shredded corn fodder, fodder ground fine like the new corn product, wheat bran and a ration of equal parts of shredded corn fodder and wheat bran, to test the digestibility of the new corn product when fed wet and when fed steamed, and to compare the digestibility of fattening rations containing the new corn product and corn blades. The value of the new corn product for producing fat was also tested. The digestion experiments were carried on by the methods usually followed at the station. After a preliminary period of 6 to 18 days the digestion experiment lasted 6 or 7 days in each case.

The steers were kept in well ventilated stalls. The bedding consisted of excelsior covered with burlap. Analyses are given of the feeding stuffs used. Several are quoted in the following table:

Composition of new corn product, finely ground corn fodder, and corn blades.

	Water.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
New corn product	9.22	6.38	2.84	48.86	28.70	4.00
Finely ground corn fodder	9.80	3.94	2.42	46.16	33.18	4.50
Corn blades	8.92	6.56	2.25	45.61	29.96	6.70

The coëfficients of digestibility of the different rations are shown in the following table:

Coëfficients of digestibility of different rations fed to steers.

	Dry matter.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
New corn product fed wet:						
Steer 1	62.84	57.22	82.19	65.71	59.75	45.64
Steer 3	63.57	59.55	83.35	65.52	60.53	54.88
Steer 4	64.02	62.26	82.89	66.13	61.42	46.07
Average for 3 steers	63.48	59.68	82.81	65.79	60.57	48.86
Shredded corn fodder fed wet, average for 2 steers[1]	60.46	36.48	74.18	59.22	69.64	29.90
Shredded corn fodder fed dry, average for 2 steers[1]	56.75	39.89	72.24	55.35	64.57	28.63
Finely ground corn fodder:						
Steer 3	57.43	37.22	78.94	59.04	59.75	30.26
Steer 4	48.89	32.85	75.98	49.00	52.12	23.49
Average for 2 steers	53.16	35.04	77.46	54.02	55.94	26.88
New corn product steamed:						
Steer 1	51.44	59.65	70.34	57.44	36.79	47.38
Steer 2	56.61	60.53	84.56	56.93	53.72	47.50
Steer 3	59.43	59.25	84.52	62.53	52.29	55.24
Average for 3 steers	55.83	59.81	79.81	58.97	47.60	50.04
Corn blades and shucks:						
Steer 1	67.58	54.60	52.78	70.66	76.01	25.61
Steer 2	65.79	49.35	63.67	66.88	74.87	34.66
Steer 3	60.22	45.62	60.00	64.63	66.73	15.40
Steer 4	61.64	41.19	56.11	63.57	74.09	14.70
Average for 4 steers	64.56	47.69	58.14	66.44	72.93	22.59
Western wheat bran:						
Steer 3	68.33	82.96	42.73	76.08	32.21	42.21
Steer 4	66.30	81.71	66.67	73.05	17.98	52.04
Average for 2 steers	67.32	82.33	54.70	74.57	25.10	47.13
Shredded corn fodder and wheat bran, 1:1, fed wet:						
Steer 1	62.43	73.08	67.41	66.81	51.76	33.08
Steer 2	63.44	75.29	71.78	67.92	54.06	25.53
Steer 3	51.25	70.05	53.24	64.96	57.59	28.54
Steer 4	65.62	76.60	80.26	66.84	59.25	42.01
Average for 4 steers	63.19	73.76	68.17	66.63	55.67	32.29
Grain[2] mixed with corn blades:						
Steer 3	56.28	64.61	73.96	61.29	51.32	3.68
Steer 4	60.33	65.19	79.08	63.34	59.84	15.81
Average for 2 steers	58.31	64.90	76.52	62.32	55.58	9.75
Grain[2] mixed with the new corn product:						
Steer 1	61.99	75.46	86.03	64.94	48.94	48.02
Steer 2	62.98	75.24	86.14	65.22	51.41	52.20
Average for 2 steers	62.49	75.35	86.09	65.08	50.18	50.11

[1] These averages and the figures for the individual animals were published in Maryland Sta. Bul. 41 (E. S. R., 8, p. 1005).
[2] The grain mixture consisted of hominy chop, wheat bran, cotton-seed meal, and linseed meal.

A further test of the relative value of fattening rations composed of mixed grain and corn blades and the new corn product was made. Two steers were fed for 60 days a ration consisting of a grain mixture (hominy chop, wheat bran, cotton-seed meal, and linseed meal) and corn blades, and two other steers were fed for the same period the same grain ration mixed with the new corn product. The average daily gain of the first lot was 3.3 lbs. and of the second lot 3.57 lbs. per head.

The author draws the following conclusions:

"The results of all the tests made show the new corn product to be a valuable stock food. They show it to be richer in composition than the whole fodder and the food compounds more digestible. The new corn product contained more pounds of digestible food per 100 lbs. of the original feed than does whole fodder, corn blades or timothy hay.

"Rations compounded with the new corn product as a base are eaten well by cattle. These rations are more digestible than the same grains fed with fodder blades and will produce more grain in live weight per 100 lbs. of food fed than the fodder blades ration. Such rations are more easily fed and there is less waste than in feeding in the ordinary manner.

"This new corn product is in such a shape that it can be easily and uniformly mixed with any kind of ground grain or any of the by-product cattle foods so common on the market. By the use of this corn product as a base it is possible to mix a complete and normal ration for stock in one bulk and which can be fed at one feeding, so obviating the necessity of feeding grain and hay separately. This is a thing that has not been possible heretofore with any class of food products on our markets in the shape in which they existed. Rations mixed in this matter are as stable and possess as great keeping qualities as cotton-seed meal or wheat bran. Animals fed upon such rations ate them with relish and kept in normal condition at all times. Cows and steers would lie down and chew their cud as naturally as when fed hay or in pasture."

Food and nutrition investigations in New Jersey in 1895 and 1896, E. B. VOORHEES (*U. S. Dept. Agr., Office of Experiment Stations Bul. 35, pp. 40*).—Investigations of the following subjects were undertaken by the New Jersey Experiment Station in coöperation with this Department: (1) The composition and cost of bread in New Jersey; (2) bakery experiments; (3) composition and cost of milk in cities in New Jersey, and (4) a dietary study.

Composition and cost of bread (pp. 7–14).—Seventy-seven samples of of bread were collected in 4 cities of New Jersey and analyzed. The cost and weight of each loaf was also recorded. The average composition of all the samples was as follows:

	Per cent.
Water	35.81
Protein	9.30
Fat	1.26
Carbohydrates	52.55
Ash	1.08

The composition of the different samples varied more or less from these values. The variation was caused (1) by the composition of the flour used in making the bread, and (2) by the different methods employed by the bakers. In some cases the bread was made of flour, yeast, water, and salt, and in other cases milk, butter, sugar, or lard were added, either alone or in combination.

The prices ranged from 3 to 10 cts. per loaf. The 3, 4, and 5 cent loaves weighed practically a pound; the 6, 7, and 8 cent loaves about 1½ pounds; and the 10-cent loaves about 2 pounds. That is, a pound of bread in the form of a 3-cent loaf cost 2.7 cts., and in a 10-cent loaf on an average 5.3 cts.

"The results of these investigations, conducted for the sole purpose of securing exact information, indicate strongly that the standard by which sales are now made and which is expressed by the term 'loaf' should be changed, because it is a variable standard, and the term 'pound of bread' should be adopted instead, or that a standard loaf should contain a definite number of pounds or ounces.

"If this were the case, a loaf of bread would, within the limits of variation in composition, contain a certain amount of nutriment. If under such a standard a consumer preferred to pay more per pound for one loaf than another, he would do so with the full knowledge that for the greater price he was not securing a proportionately increased amount of nutriment."

Bakery experiments (pp. 14–20).—Two experiments were made under the author's supervision in a well-equipped bakery in New Brunswick, New Jersey, for the purpose of studying the changes which the various materials used undergo in the process of making bread. The bread was made from flour, yeast, and water, with a little sugar and salt, and in each experiment butter and lard were added to half the dough. The total loss of dry matter in baking the bread amounted to about 3 per cent. In one experiment the bread contained somewhat more protein, and in the other somewhat less than the flour from which it was made. "It may be safely said that no loss of protein occurs in the changes which take place in making bread."

It has been claimed that in making bread there is a loss of from 1½ to 2 per cent of carbohydrates, due to fermentation. Such a loss was not found in the present experiments. "Both experiments showed a very considerable loss of fat during baking; that is, the fats shown by analysis to be contained in the materials used were not found in the baked bread." In order to study this point further the fuel values of the various materials were calculated and also determined by a bomb calorimeter.

"It was believed that if fats were simply rendered nonextractable by the process of baking, the test with the bomb calorimeter would reveal the fact. In an analysis nonextractable fats would be classed as carbohydrates, which have a much lower fuel value than the fats, and thus the fuel value obtained by calculations based on percentage composition would be proportionately lower than the fuel value obtained by actual determinations with the bomb calorimeter.

"The results obtained show a higher fuel value by actual experiment than by calculation, both in the materials and in the bread. They rather verify than disprove the indications that an actual loss of fat occurs in the process of baking, and that the loss is much greater than was formerly supposed. Further experiments are now in progress along these lines."

The cost of the materials used in making bread as compared with the usual selling price of the bread is discussed at length.

"The first important point shown by this work is the relation of the weights of bread to the weight of flour used. In experiment No. 1, 100 lbs. of flour made 141.5 lbs., and in No. 2, 144.8 lbs. . . .

"In the second place, it is shown that 100 lbs. of flour, which costs $1.95, plus the usual amount of other materials added, which cost on the average 49 cts., making a total cost of $2.44, will produce bread sold for $5.97; that is, making the materials into bread has increased the cost $3.53. Stated in another way, the actual nutrients that would cost $1 in the form of flour, lard, butter, yeast, salt, etc., would cost $2.49 if bought in the form of bread; that is, the consumer must pay $1.49 for making materials that cost $1 into bread and for distributing and selling the bread. . . .

"One bushel of wheat (60 lbs.) will make about 44 lbs. of flour; one barrel of flour is therefore equivalent to 4.5 bu. of wheat. The producer receives, at 65 cts. per bushel, $2.93 for wheat equivalent to one barrel of flour. The baker pays approximately $4 for the flour. The difference, $1.07, or 40 per cent of the first cost, plus about 72 lbs. of by-products, viz, bran, middlings, and coarse flour, worth at present prices 54 cts., represents the charges of manufacturing and carriage to the baker. The baker manufactures the flour into bread, adding lard, etc., worth about 96 cts., and the consumer pays $10.74 for the bread produced. The difference, representing the charges of the baker, or the increase in the cost of nutrients between the flour and the bread, is $5.78, or 116.5 per cent. In other words, $100 worth of flour and other raw materials are made into bread which sells for $216.50.

"It would seem, therefore, that the increased cost of nutrients due to the transformations taking place between the producer and consumer, are chargeable in greater measure to the baker than to the miller.

"These facts having been derived from actual experiment, it remains for the consumer to determine whether, under his conditions, it will be more economical to purchase the bread or to purchase the flour and other materials and to incur the other expenses necessary in the baking of bread at home."

The composition and cost of milk (pp. 20–30).—One hundred and eight samples of milk were collected for analysis in 4 cities in New Jersey. The samples were analyzed and their cost recorded. The average composition was as follows:

	Per cent.
Total solids	12.97
Fat	4.13
Casein and albumen	3.37
Sugar	4.75
Ash	.72

In the author's opinion the milk was on an average extremely good. The usual price of the milk was 8 cts. a quart. Some samples were purchased for 6 cts. a quart, the lower cost being due to the fact that the milk was not delivered. The fat content of the milk was found to vary within wide limits. On the basis of its fat content the author divided the samples into 8 classes, the first containing less than 3 per cent fat and the eighth over 6 per cent. The majority of the samples were of the third class, containing from 3.5 to 4 per cent fat. The total solids also varied considerably.

"Assuming that the percentage of fat is a safe guide to the nutritive value of milk—an assumption practically borne out by this study—the content of this constituent would furnish a better standard than the quart. For instance, the average of all the milks examined, which at the average price of 8 cts. per quart cost $4 per hundred, contained in round numbers 4 per cent, or 4 lbs., per hundred of fat. If milk containing 4 per cent of fat is worth 8 cts. per quart, milk containing 3.50 per cent would, on the same basis, be worth 7 cts. per quart; and milk containing 3 per cent only 6 cts. per quart. On the other hand, milk containing 4.50 per cent of fat would be worth 9 cts. per quart, and that containing 5 per cent of fat, 10 cts. per quart."

The author urges the adoption of the fat content standard as a basis in selling milk.

The influence of the character of the rations fed and of the individual characteristics of the cows upon the composition of the milk is briefly discussed.

The dietary study (pp. 30–40).—A dietary study was made of a mechanic's family by the usual methods.[1] The results of the investigation, including analyses, are expressed in full. The nutrients consumed per man per day and their cost were as follows: Protein, 100 gm.; fat, 138 gm.; carbohydrates, 425 gm.; fuel value, 3,435 calories; nutritive ratio, 1:7.4; cost, 25 cts. This investigation is compared with the results of similar studies made elsewhere.

"The New Jersey dietary did not differ more widely from the dietaries of professional men, farmers, and students' clubs than from the average dietaries of other mechanics' families.

"[The cost of the food in this dietary was rather higher than usual in similar studies.] Two articles were purchased, namely, oranges and celery, which added comparatively little to the food value of the dietary, but increased the cost very materially. This family spent 14.8 per cent of the whole cost of the food for celery and oranges, and in return got only 1.2 per cent of the total protein and 1.4 per cent of the total fuel value. The oranges and celery certainly added to the attractiveness of the dietary, but the use of such articles of diet must of course be governed by the resources of the family."

On the importance of the physiological requirements of the animal body: Results of an attempt to grow cattle without coarse feed, E. DAVENPORT (*Illinois Sta. Bul. 46, pp. 362–371*).—The author made tests with 4 calves to study the effect of feeding a ration which contained no coarse fodder. Calf No. 1, a grade Shorthorn, was fed at first large quantities of milk and later a grain ration of corn and oats (1:1). When about 5 months old the calf consumed a half bushel of grain daily. Though large amounts of food were consumed the calf always seemed hungry. When about 4 months old its joints began to swell and the legs to stiffen. When about 5 months old disturbances of the nerve centers appeared and the calf was killed, since it was evident it would not live much longer.

Calf No. 2, a Shorthorn-Friesian-Jersey, was fed for 7 months on skim milk exclusively. For some time its appetite was abnormally large and it was not satisfied with 50 lbs. of skim milk daily. Later there was a loss of appetite, the legs became stiff, and it was evident that if the diet were continued the calf would not live. It was therefore given straw, which it ate greedily. Three hours after taking the coarse food it chewed its cud for the first time in its life and recovery was rapid.

Calf No. 3, a grade Jersey, was fed milk at first and later some grain. At one time more than 70 lbs. of milk were consumed per day. Later the appetite diminished and the calf appeared entirely indifferent to food. After being deprived of coarse fodder for about 5 months it was given hay and recovered its normal condition rapidly.

Calf No. 4, a high grade Jersey, was weaned early and put on a diet of milk and grain and later grain alone. After about 3 months the calf suddenly sickened and died.

In no case did the calves chew the cud when no coarse fodder was consumed, although the amount of grain eaten was large. In the early

[1] U. S. Dept. Agr., Office of Experiment Stations Bul. 21 (E. S. R., 7, p. 148).

part of the test the calves had abnormal appetites, which after a time diminished. Digestive disorders were not noted except in the case of calf No. 4. The bowels remained regular and the feces appeared normal. The calves gained in weight on a ration without coarse fodder, but always looked poor. For instance, calf No. 2 on a diet of skim milk gained 138 lbs. in the first 100 days of the test, consuming 25 lbs. of milk per pound of gain. During the 7 months of the test the calf gained 226 lbs. on an exclusive diet of skim milk. Yet the calves "were not thin like calves which had suffered from insufficient food."

Post-mortem examinations of calves Nos. 1 and 4 showed that there was no visible fat on the carcass, though the muscular tissue was firm and hard.

"As starvation in mature animals is accompanied by a wasting of the tissues, especially fat, so here starvation by imperfect nutrition during development resulted in the total absence of fat. . . .

"There is a popular belief that starvation in all its stages is an acute and painful condition incident only upon insufficient amounts of food. There could be no greater error. These experiments appear to teach that starvation partial or complete may ensue upon an apparently slight interference with constitutional habit."

Steer and heifer beef, J. WILSON and C. F. CURTISS (*Iowa Sta. Bul. 33, pp. 566–590, figs. 7*).—This experiment is a continuation of previous work reported in Bulletin 24 of the station (E. S. R., 6, p. 321). Thirteen calves 6 to 7 months old, of which 5 were steers and 8 heifers, were purchased about the 1st of November. Five of the heifers were spayed. The calves were grazed on good pasture and fed a moderate amount of corn and grain in addition. Up to December 1 the steers had gained on an average 71 lbs., the spayed heifers 40 lbs., and the open heifers 66⅔ lbs. In the authors' opinion this indicates that spaying had no particular influence on the gain.

Two heifer calves which were purchased somewhat later were put with the other open heifers. All the calves were fed cut corn fodder, roots, and a moderate grain ration until the test proper, which began January 1 and lasted 14 months. During the test one heifer met with an accident and was dropped. From the beginning of the test until June 1 the cattle were all fed hay and grain with some roots. The grain ration consisted of cotton-seed meal, bran, gluten meal or oats, corn-and-cob meal. Snapped corn, green sweet corn, corn fodder, and clover were also fed. During the summer the cattle were on pasture until October 1. The grain ration, which was gradually dropped when the cattle were put on pasture, was resumed when they were taken from the pasture and continued until the end of the experiment. The steers, open heifers, and spayed heifers were kept in separate feeding yards with sheds. They were given all the food they would eat up clean, and had access at all times to water and salt. When on pasture the 3 lots were grazed on equal areas.

The feeds used prior to and after the grazing period were rated at the following prices per 100 lbs., based on local market values prevailing at the time.

Price per 100 lbs. of different feeding stuffs.

	Before grazing period.	After grazing period.
	Cents.	*Cents.*
Gluten meal	70.0	....
Cotton-seed meal	....	85.0
Snapped corn	56.0	20.0
Oats	....	40.0
Hay	30.0	28.0
Corn fodder	20.0	....
Corn stover	....	10.0
Corn-and-cob meal	75.0	30.0
Bran	70.0	40.0
Ear corn	65.0	....
Mangel-wurzels	5.0	5.0
Green clover	2.5	....
Green sweet corn	....	2.5

Pasture was charged at the rate of $1 per head per month.

The results of the experiment, which are given in tabular form, are summarized in the following table:

Results of feeding steers and heifers for beef.

	Average weight at end of test.	Average daily gain per head for entire period.	Average daily gain per head for 10 months not on grass.	Dry matter eaten per pound of gain.	Average cost of feed per pound of gain for 10 months not on grass.	Average cost of feed per pound of gain for entire period.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Cents.*	*Cents.*
Steers	1,388	1.71	2.07	8.70	3.90	4.08
Open heifers	1,300	1.86	2.26	7.67	3.47	3.65
Spayed heifers	1,337	1.70	2.03	8.60	3.88	4.05

The cattle were sold in Chicago. The steers brought $4.50 and the heifers $4.25 per hundred. The price received was in advance of that paid for any other lot of cattle on the day of sale. The loss of weight during transportation was 50 lbs. for the steers and 53 and 59 lbs. for the spayed and open heifers, respectively. The animals were slaughtered and the weights of the carcasses and of the offal, hides, flesh, organs, etc., and the percentage that each formed of the whole carcass were recorded. The carcasses were cut up and judged by an expert. The weight and cost of each cut and the percentage of the whole carcass were determined. The percentage of highest-priced cuts, ribs, and loins was greater in both lots of heifers than in the case of the steers. The average cost of the beef to the firm purchasing the cattle was 6.51 cts. for the steers, 6.21 cts. for the spayed heifers, and 6.14 cts. for the open heifers. The average selling price received by them was 6.59 cts., 6.26 cts., and 6.24 cts., respectively.

The following conclusions were drawn:

"The heifers made a slightly greater average gain from correspondingly less feed, and at less cost than the steers. . . .

"The results of this experiment fully confirm the indications of the former work at this station, viz, that the merits and relative value of heifer beef have been underestimated. . . .

"Carefully conducted slaughter and block tests have not revealed any material difference in the character, composition, or quality of the meat from the steers and heifers used in these experiments.

"But little if any benefit has been derived from spaying.

"In both cases the heifers have given more profitable carcasses on the block, even when granting the higher valuation put on the leading cuts from the steers."

Feeding lambs, J. WILSON and C. F. CURTISS (*Iowa Sta. Bul. 33, pp. 527–565, figs. 18*).—A feeding experiment was made with 5 yearling sheep and 109 lambs, 10 of which were range lambs and the remainder of the following breeds: Southdown, Shropshire, Oxford, Suffolk, Lincoln, Cotswold, Leicester, Dorset, and crossbred Shropshire on Merino. The sheep were purchased in November. As soon as they arrived at the station, they were all put on blue-grass pasture and in addition were fed oats twice a day. The rams were castrated. The latter part of November the lambs were divided into 10 lots of 10 each and 1 lot of 9, each breed constituting one lot; and the 5 yearlings composed 1 lot. Each lot was put into a shed facing south connected with a small yard. They were given an abundance of bedding and supplied with salt.

The experiment proper began January 1 and lasted 3 months. All the lots were fed hay of various sorts, grain, and some roots. The hay and grain were fed principally in the morning and at night and the roots were fed at noon. The various grains were thoroughly mixed and fed in a trough and the hay was fed in racks.

During the preliminary period on pasture and for the first 10 days of the experiment proper the grain ration consisted of bran, oats, and corn, in the proportion of 1:4:4. The ration was then gradually changed to bran, linseed meal, oats, and shelled corn, in the proportion of 1:2:8:8. This ration was continued until the close of the experiment, and the animals were given all the food they would eat. The financial statement is based on bran and oats at 40 cts., shelled corn at 28½ cts., linseed meal at 90 cts., hay at 28 cts. and turnips and mangel-wurzels at 5 cts. per 100 lbs. The details of the experiment are given in tabular form. The results are summarized in the following table:

Results of feeding different breeds of sheep.

	Food consumed.					Average weight at beginning.	Average daily gain per head.	Dry matter eaten per pound of gain.	Cost of feed per pound of gain.
	Corn and oats.	Bran.	Linseed meal.	Roots.	Hay.[1]				
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lb.*	*Lbs.*	*Cents.*
Lot 1 (Southdown lambs)	1,504	111	174	734	1,541	912	0.45	7.38	2.93
Lot 2 (Shropshire lambs)	1,615	120	189	782	1,523	1,007	.48	7.18	2.88
Lot 3 (Oxford lambs)	1,864	137	216	1,100	1,791	1,190	.52	7.40	3.03
Lot 4 (Suffolk lambs)	1,901	141	223	900	1,832	1,165	.55	7.40	2.95
Lot 5 (Lincoln lambs)	1,858	138	217	901	1,840	1,206	.55	7.29	2.89
Lot 6 (Leicester lambs)	1,586	122	193	911	1,619	1,186	.52	7.49	2.93
Lot 7 (Cotswold lambs)	1,858	138	217	901	1,844	1,183	.62	6.53	2.60
Lot 8 (Dorset lambs)	1,720	127	200	970	1,749	1,009	.48	7.85	3.05
Lot 9 (Merino lambs)	1,358	101	157	743	1,041	822	.29	9.35	3.78
Lot 10 (Crossbred lambs)	1,427	107	166	743	1,170	810	.41	7.02	2.82
Lot 11 (Range lambs)	1,142	84	133	507	1,183	707	.37	6.84	2.71
Total, all breeds	17,833	1,326	2,085	8,992	17,133	....	.48	7.37	2.93
Total, first 7 breeds	12,186	907	1,429	5,929	2,990	....	.53	7.25	2.88
Lot 12 (Shropshire yearlings)	927	71	107	180	699	840	.33	11.00	4.44

[1] Clover and pea hay with a little timothy.

The experiment is discussed in relation to experiments made elsewhere. The lambs consumed on an average 7.37 lbs. of dry matter per pound of gain. A compilation made at the Ohio station[1] shows that an average of 10.24 lbs. of dry matter were consumed by cattle to a pound of gain, while Lawes and Gilbert estimated that cattle required 11 lbs. and sheep 9 lbs. of dry matter for a pound of gain. "The better results from both cattle and sheep at the Iowa station than those reported elsewhere are doubtless in part due to the fact that younger animals were used. . . . The evidence all indicates a higher gain, however, from a given amount of grain fed to sheep than when fed to cattle." The results of this experiment are compared with those of an experiment with cattle (p. 82):

"In summing up this comparison we find that while the sheep ate 48 per cent more per 1,000 lbs. live weight than cattle, they also gained nearly 75 per cent more. . . . Other things being equal, the sheep apparently makes more economical gain than the steer. There are two other features that should also be noted in this connection viz, the value of the droppings from cattle and the returns from the fleece of the sheep. While these are quite variable, it is safe to say that the wool feature will usually compensate for any advantage the cattle may have in the droppings."

The water consumed per 1,000 lbs. live weight and per pound of gain was also determined, but no marked variations were noticed between the different breeds of sheep.

Shortly before the close of the experiment the sheep were sheared. The weight of each fleece and the average weight for each breed were recorded. Later in the season the wool was sold and the loss of weight in scouring and the value of the wool when scoured were ascertained. These data are given in the following table:

Results of shearing sheep.

	Average age of fleece.	Average weight of fleece.	Value per pound in natural condition.	Shrinkage in scouring.	Value per pound in scoured condition.	Value of fleece per head.
	Days.	*Lbs.*	*Cents.*	*Per cent.*	*Cents.*	
10 Southdown lambs	366	6.750	11.50	54.25	26.00	[1]$0.75
10 Shropshire lambs	363	8.750	11.00	56.25	25.00	.98
10 Oxford lambs	365	10.950	12.75	47.00	24.00	1.44
10 Suffolk lambs	384	7.650	11.00	54.25	24.00	.86
10 Lincoln lambs	332	12.850	13.75	40.00	23.00	1.79
9 Leicester lambs	348	11.500	14.75	38.50	24.00	1.76
10 Cotswold lambs	334	12.650	13.00	43.33	23.00	1.66
10 Dorset lambs	355	6.825	10.75	55.25	24.00	.77
10 Merino lambs	359	9.900	9.75	67.50	30.00	1.00
10 Crossbred lambs	334	7.500	11.75	53.00	25.00	.90
10 Range lambs	321	5.125	12.50	48.00	24.00	.67
10 Shropshire yearlings	318	10.500	12.25	49.00	24.00	1.34

[1] The values in this column are obtained by dividing the value of wool from each breed by the number of sheep. The Chicago weights varied a little from the home weights taken at date of shearing.

At the close of the experiment the sheep were sold in Chicago at $4.25 to $4.75 per hundred, except one lot (the Dorsets), which brought only $3.75 per hundred. It was found on slaughtering that the dressed weight of the lambs was from 51.8 to 57.8 per cent of the live weight

[1] Ohio Sta. Bul. 60 (E. S. R., 8, p. 75).

and the dressed weight of the yearlings was 62.3 per cent of the live weight.

A detailed record is given in tabular form of the slaughter test, which shows the net weight of the several parts of the carcass, of the internal organs and offal, and the percentage of the whole which each constituted. The carcasses were cut up and the meat judged by an expert. Taking into account the value of the offal, tallow, pelts, etc., the cost of the dressed mutton to the firm handling it was computed for each breed. The difference between this sum and the calculated selling price shows the profits for each breed. The data are shown in the following table:

Profits in dressing the sheep.

	Dressed, cost price.	Dressed, selling price.	Difference.
Southdowns	$6.66	$7.50	$0.84
Shropshires	6.31	7.46	1.15
Oxfords	6.53	6.71	.18
Suffolks	6.20	6.50	.30
Lincolns	6.39	6.69	.30
Leicesters	6.20	6.68	.48
Cotswolds	6.50	6.69	.19
Dorsets	5.27	6.15	.88
Merinos	5.82	6.75	.93
Crossbreds	6.20	7.16	.96
Range	5.79	6.74	.95
Average	6.17	6.82	.65

It would seem from this experiment that sheep which are usually raised for wool may also be profitably fattened.

Pig feeding, W. P. WHEELER (*New York State Sta. Rpt. 1895, pp. 475–493*).—Three feeding tests are reported with pigs of different breeds and crosses. The first test was made with 5 lots of pigs. It began in the summer of 1894 and lasted 196 days, except in the case of lot 5, which was fed 186 days. Lot 1 consisted of 3 Tamworths, lot 2 of 5 Poland-Chinas, lot 3 of 5 Tamworth-Durocs, lot 4 of 6 Tamworth-Poland-Chinas, and lot 5 of 5 Berkshires. Three pigs were dropped from lot 3 and 1 from lot 5 before the end of the test. The pigs ran with the sows for 4 weeks after farrowing. After the pigs were taken from the sows they were fed skim milk, wheat bran, and for longer or shorter periods the following grain rations in the order mentioned: Wheat bran and wheat middlings, 1:1; wheat bran, wheat middlings, and corn meal, 1:1:1; corn meal, wheat bran, and wheat middlings, 4:1:1; corn meal, wheat bran, and wheat middlings, 10:1:1, and corn meal, wheat bran, and wheat middlings, 20:2:1. The amount of corn meal in these rations was increased as the pigs approached maturity. The pigs were fed 3 times a day. During the cold weather they were kept in pens, and while the weather was warm they had the run of small yards. They were given charcoal once a week.

The financial statement is based on wheat bran at $18, wheat middlings at $20, and corn meal at $20 per ton, and skim milk at 25 cts. per

100 lbs. The results for each pig are given in tabular form. The gain made by the Tamworth-Duroc pigs cost 4.58 cts., the Poland-Chinas 3.78 cts., the Tamworths 3.63 cts., the Tamworth-Poland Chinas 3.72 cts., and the Berkshires 3.66 cts. per pound. The sows generally lost weight while they remained with the pigs.

The second test was made in the winter of 1894–95 with 5 lots of pigs made up as follows: Lot 1, 7 Poland-Chinas; lot 2, 10 Tamworths; lot 3, 8 Yorkshires; lot 4, 8 Tamworth-Poland-Chinas, and lot 5, 6 Tamworth-Durocs. Five and six pigs were dropped from lots 1 and 2, respectively, before the end of the test, and 2 pigs each from lots 3 and 5. The trial lasted from 56 to 224 days. The pigs were fed under the same general conditions as in the first test. The results for each pig are expressed in full in tabular form. The average cost per pound of gain for the Poland-Chinas was 4.22 cts. and for the Tamworths 3.95 cts.

"For the first four weeks, while fed with the sow the Yorkshire pigs made the most economical growth and the Tamworth the most costly. The Tamworth sow, however, gave very little milk and the pigs were at much disadvantage for some weeks on this account. For the first month after removal of the sow the Tamworth pig made growth at the same cost as the Yorkshire, and more rapidly."

The third test, which lasted 224 days, was made with 4 lots of pigs, as follows: Lot 1, 6 Poland-Chinas; lot 2, 3 Tamworths; lot 3, 9 Yorkshires, and lot 4, 4 Tamworth-Durocs. Two, one, and five pigs were dropped from lots 1, 2, and 3, respectively, before the close of the test. The pigs were fed under the same general conditions as in the first test. The results are expressed in full in tabular form. The average cost per pound of gain for the Poland-Chinas was 3.44 cts., for the Yorkshires 3.34 cts., for the Tamworths 3.81 cts., and for the Tamworth-Durocs 3.39 cts. The total gain made by the Tamworths was about 222 lbs., the Tamworth-Durocs about 209 lbs., the Poland-Chinas about 192 lbs., and the Yorkshires 158 lbs.

"The cost of growth of pigs during the first month while fed with the sow was least with the Yorkshires, as in the former trial, and highest with the Tamworths. The growth for the first month or so after removal from the sow was at least cost with the Poland-China pigs."

England's food supply in a time of war, H. SETON-KARR (*North Amer. Rev., 164 (1897), No. 6, pp. 651–653*).

The changes in the constituents of coffee beans due to roasting, A. JUCKENACK and A. HILGER (*Forsch. Ber. Lebensmitl., 4 (1897), No. 5, pp. 119–135*).

Making spaghetti, E. L. WILLIAMS (*Sci. Amer., 76 (1897), No. 22, pp. 340, 341, figs. 5*).—A popular article.

On the unpleasant odor of the flesh of bulls and the odor of flesh in general, GOLTZ (*Ztschr. Fleisch- u. Milchhyg., 7 (1897), No. 8, pp. 147–156*).

Hens' eggs as food and the preservation of eggs, R. STRAUCH (*Das Hühnerei als Nahrungsmittel und die Conservirung der Eier. Bremen: M. Heinsius, 1896, pp. 51*).

Some of the changes which take place in eggs, M. RUBNER (*Hyg. Rundschau, 6 (1896), pp. 761; abs. in Vierteljahr. Chem. Nahr. u. Genussmitl., 11 (1896), No. 4, p. 475*).—The author discusses the changes due to bacterial action.

Popular errors in living and their influence over the public health, C. W. PURDY (*North Amer. Rev., 164 (1897), No. 6, pp. 664–677*).—In a popular article the author calls attention to the dangers of overeating, especially the eating of excessive quantities of meat and starchy foods.

What to eat in warm weather, or warm weather dietetics, LOUISE E. HOGAN (*Dietet. and Hyg. Gaz., 13 (1897), No. 6, pp. 349–352*).

Observations on excessive intestinal putrefaction, C. A. HERTER and E. E. SMITH (*Trans. N. Y. Acad. Med., 2. ser., 11 (1895), pp. 26–125*).—The influence of intestinal putrefaction on the ratio of præformed to combined sulphur in the urine was determined in a large number of cases. The urea and indican in the urine were also determined. The relation of diet to intestinal putrefaction is discussed, the whole subject being treated from a medical standpoint.

The influence of the variation of moisture content of motionless air upon man when no muscular work is done, M. RUBNER and VON LEWASCHEW (*Arch. Hyg., 29 (1897), No. 1, pp. 1–55*).

Soiling and soiling crops, A. W. KASTRUP (*Landmandsblade, 29 (1896), pp. 693–696, 717, 729–732, 748–752, 765–767, 777–781; 30 (1897), pp. 3–7*).

Feeding experiments with silage, R. WAHLQUIST (*Nord. Mejeri Tidn., 11 (1896), pp. 486, 487*).

Animal husbandry in Denmark, 1896, A. APPEL (*Tidsskr. Landökon., 16 (1897), pp. 53–70*).

Cattle farming in Denmark, Germany, Holland, and Great Britain, G. J. LEUFVÉN (*K. landt. Akad. Handl. Tidskr., 35 (1896), pp. 265–325*).

Cattle and hog raising in Denmark, M. MOE (*Tidsskr. norske Landbr., 4 (1897), pp. 171–181*).

Steer feeding at the Kansas station, C. C. GEORGESON (*Proc. 17th Ann. Meeting Soc. Promotion Agl. Sci., pp. 81–87*).—The author discusses experiments in feeding steers at the Kansas station during the past five years.

Value of folding, J. WRIGHTSON (*Agl. Gaz. [London], 45 (1897), No. 1216, p. 370*).—A popular article on the folding of sheep and its effect on various crops.

Horse raising in Denmark, 1896, J. JENSEN (*Tidsskr. Landökon., 16 (1897), pp. 71–87*).

Poultry, W. P. WHEELER (*New York State Sta. Rpt. 1895, pp. 494–516*).—A reprint of Bulletin 90 of the station (E. S. R., 7, p. 423).

Fattening of poultry, J. KORSHOLM (*Landmansblade, 29 (1896), pp. 768–770*).

DAIRY FARMING—DAIRYING.

Dairying in California, E. J. WICKSON (*U. S. Dept. Agr., Bureau of Animal Industry Bul. 14, pp. 31*).—This is an interesting account of the history, development, and present status of dairying in California. The author divides the dairy lands of the State into 4 chief divisions somewhat analogous to the mountain dairying of the Alpine valleys, the moist diked lands of Holland, the heated irrigated plains of Italy, and the coast lands of Normandy. Each of these divisions is described, together with the conditions of stock, feed, and pasturage, milking season, and winter feeding, drought-resisting forage plants, winter shelter, and general management of dairy herds.

"The estimates of a satisfactory yearly product for an average cow, furnished by a large number of dairymen, vary widely. One correspondent places it as low as 150 lbs. of butter, and several cite 300 lbs. From 200 to 250 lbs. of butter in a year is the range mentioned by most correspondents. Though there are bands of 30 to 80 cows reported from Humboldt County as ranging from 275 to 325 lbs. of butter yearly, it is plain that such dairies are above the average, both in breeding and selection, or in feeding, or in both."

There are said to be about 300 establishments operated upon the creamery plan in the State, of which 100 are creameries receiving milk from a number of patrons, and 200 are private dairies with power separators and other creamery apparatus.

"These 'private creameries' average about 150 cows each, with some of them having as high as 400 cows. The coöperative creameries range in cows from 250 to 4,000, with an average of 500 cows. Of these establishments about one-half are proprietary and the other half about equally divided between joint-stock and coöperative. . . .

"The largest creamery in California is the establishment of the Guadalupe Creamery Company (coöperative), located at Guadalupe, on the coast, in the northwest corner of Santa Barbara County. It has capacity for the milk of nearly 4,000 cows, and is in a region of very large dairy holdings. It has one skimming station and uses altogether six separators, mostly of the Alpha De Laval pattern, and has received at times 60,000 lbs. of milk per day.

The milk values in different months are given, together with an account of farm dairies in California, the California butter roll and forms of cheese, the dairy markets of the State, shipment of California butter east, and dairy organization and protection.

"The farm dairy, as it is understood at the East, is very rare in California. . . .

"Almost all the cheese made in California (except that made occasionally in creameries during low butter prices) is the product of proprietary concerns, and probably nine-tenths of it is from milk produced by cows owned or leased by the maker. The product is therefore almost wholly farm or ranch cheese, but the reader will understand that many of these farms produce as much milk as is received by the smaller Eastern 'factories' and manufacture it in as enlightened a manner. Farm dairy cheese, as the term is used in the East, is hardly known in California. . . .

"Of the cheese branch of California dairying it may be said that it has never been developed as the natural adaptations of the State suggest."

The cheese industry of the State of New York, B. D. GILBERT (*U. S. Dept. Agr., Bureau of Animal Industry Bul. 15, pp. 54*).—This bulletin gives the history of cheese making in New York, the New England States, and Pennsylvania; statistics of cheese production for New York and for the whole United States, beginning with 1840; statistics of exports and imports of cheese for the whole United States; a description of different kinds of fancy cheese and of the principal factories where they are made in New York, and chapters on the dairy boards of trade in the State of New York, cheese factories in New York, and the future of the American cheese trade. The bulletin also includes a detailed popular description of the modern methods practiced in the United States in making factory cheese, by G. Merry, a practical cheese maker, who is said to have won many high prizes for his work. An appendix to the bulletin gives tables showing the cheese production and traffic in New York State.

The author notes the prosperous condition of the cheese industry which previously existed, and attempts to explain the causes of the decline. He states that "in the year ending May 1, 1896, the proportion of exports [of cheese] is about 5 for Canada and 2 for the United

States." One cause of decline is believed to be a decrease in the consumption of cheese in England due to the shipment of frozen meats from Australia and South America to England, which are sold at a lower price than formerly. Another very important cause is believed to be the manufacture and sale of filled cheese. This matter is discussed in considerable detail, and the measures which have been taken in the different States against filled cheese are noted.

As to the importation of cheese into the United States, it is shown that, in 1885, 6,247,560 lbs. of cheese, valued at $964,587, was imported, while in 1895 this had increased to 10,440,863 lbs., valued at $1,471,091.

"It will be seen that our imports have increased 67 per cent in the 11 years enumerated above, while our exports during the same period have diminished in just about the same proportion. At an average price of 8½ cts. for the cheese sent abroad the past year, the value of our exports is only as much again as the money paid out for imports. Nearly a million and a half of dollars was paid to foreign countries for cheese delicacies, a portion of which might be made at home if our dairymen and cheese makers would only do their work in the right and proper way. . . .

"It will be seen at a glance that the importations from Switzerland and Italy comprise more than three-fourths of the whole amount, and that of the remainder the Netherlands contribute about 36 per cent and France about one-third. The cheese from France is principally Roquefort, Camembert, and Brie. Of these last two varieties we make a certain amount, but they do not compare favorably in quality with the foreign goods. The stock imported from the Netherlands is composed chiefly of Edams, although there are also a few Goudas. Some attempt has been made to produce Edams in Wisconsin, but it has not proved to be a success. So far as can be learned, there ought to be no serious obstacle to producing a fine quality of Edam cheese in this country.

"American sweitzer is made not only in New York, but in Ohio, Indiana, Michigan, Wisconsin, West Virginia, and on the Pacific Coast. The product of Wisconsin is decidedly preferred to that of the other States by dealers in New York City. At the same time it is far from being equal to the imported Swiss cheese, as is shown by the prices at which it sells. The foreign article was sold by importers in the early winter of 1896 at 19 to 20 cts., while the same parties jobbed American sweitzer at 12 to 13 cts. There could be no such difference as this if there was anything like a parity in the quality of the two. Nearly 5,000,000 lbs. of imported Swiss cheese is used in this country.

"[A liberal estimate] would place the entire make of Swiss cheese in this country at 2,500,000 lbs., which is about one-half of the amount imported. It shows that there is a wide margin here for the improvement and extension of manufacture of this class of goods also.

"The importations from Italy consist of 7 varieties, viz: Romano, Reggiano, Parmesan, Gorgonzola, Caccio Cavallo, Formaggio di Bra, and Canestrato. Of these, the Romano is most largely imported, while Parmesan and Reggiano come next. Of the other 4 varieties only small quantities of such are brought over, three of them belonging to a class which may properly be called noncivilized cheese. The Romano variety is made from the milk of buffaloes, [which] contains hardly any butter fat, and there would seem to be no great hindrance to the production of Romano cheese in this country out of skimmed milk, providing the correct method of manufacture was followed and the requisite time given for curing. But it is not probable that Parmesan cheese could be produced here successfully. . . . Reggiano, which is made of full cream, is a mild and wholly civilized cheese, but requires long age to perfect it."

The principal kinds of fancy cheese manufactured in New York are Limburger, domestic Swiss, Münster, Brie, d'Isigny, Neufchâtel, Hand, Wiener, and Camembert. The principal factories where these are made are briefly described and descriptions given of the different kinds of cheese.

"The total amount of fancy cheese annually manufactured by these 7 establishments is about 3,500,000 lbs. . . .

"Limburger has been so successfully made in this country that the domestic article has practically superseded the foreign, and very little of the latter is now imported. . . .

"The low prices of Cheddar cheese in 1895 did not affect the price of soft cheeses to any considerable extent, nor does the season of the year affect them. . . .

"The sale of fancy cheese is increasing rapidly, and the enormous falling off in our export of Cheddar cheese will, if it continues much longer, compel the factory men to enter upon some other branch of the business."

In discussing the question as to what should be done to improve the conditions surrounding the cheese industry, the author suggests that the first and most obvious requisite is to make better cheese, which will compete with the foreign cheese; to make a greater number of kinds of cheese instead of confining the manufacture so largely to Cheddar cheese, and to retain the markets of the South and the West.

"With proper laws to protect the cheese industry against frauds, with greater variety in the styles of cheese made, and with an improvement in the quality of our goods, there is no good reason why our cheese dairies should not become as prosperous as they were before the disastrous season of 1895."

Report of the first assistant, W. P. Wheeler (*New York State Sta. Rpt. 1895, pp. 391–474*).—Brief statements are given in regard to the care of the station herd during the year; a reprint of Bulletin 97 of the station, on "Corn silage for milch cows" (E. S. R., 8, p. 160), and accounts of miscellaneous feeding trials. Under the latter head the data are tabulated for 4 feeding trials, in which comparisons were made of sorghum fodder, corn fodder, and beets; oat and pea fodder and alfalfa fodder; and corn silage, alfalfa, and beets. Analyses are given of the feeding stuffs used, including clover and timothy hay and mixed grain, in addition to the green fodders. The change in coarse fodder was usually accompanied by a greater or less change in the grain, which prevented drawing conclusions as to the effect of the different coarse fodders. "At the prices of foods consumed, there has always been a cheaper supply of nutriment in the green fodder or in silage than in grain."

Fresh cow vs. stripper butter, G. L. McKay and C. H. Eckles (*Iowa Sta Bul. 33, pp. 606–609*).—A test was made with 2 lots of 15 and 18 cows, respectively, to study the effect of period of lactation upon the quality of butter. The first lot averaged 239 days since calving and the second lot 107 days. Cream from the milk of both lots was removed with a separator, and the butter was made and handled by the same methods. It was judged by an expert. No difference in the butter from the 2 lots was observed.

Dairying in Denmark, 1896, B. Bøggild (*Tidsskr. Landökon., 16 (1897), pp. 88–120*).

Different methods of utilization of milk, R. Wahlqvist (*Nord. Mejeri Tidn., 11 (1896), pp. 496–498*).

Corn silage for milch cows, W. P. Wheeler (*New York State Sta. Rpt. 1895, pp. 393–452*).—A reprint of Bulletin 97 of the station (E. S. R., 8, p. 160).

Automatic weighing of cows' milk in the dairy barn, O. Lindemann (*Nord. Mejeri Tidn., 11 (1896), pp. 390, 391, 400, 401*).

Examination of the fat content of the milk of Kildebrönd cows, L. HANSEN (*Ugeskr. Landm., 42 (1897), pp. 220–222*).

Comparative profits derived from selling milk, butter, cream, and cheese, L. L. VAN SLYKE (*New York State Sta. Rpt. 1895, pp. 11–25*).—A reprint of Bulletin 89 of the station (E. S. R., 7, p. 423).

The acid test for milk and cream, W. J. SPILLMAN (*Washington Sta. Bul. 24, pp. 7, fig. 1*).—A description is given of the method of using Farrington's alkaline tablets in testing the acidity of milk, and a graduate devised by the author for making the test is illustrated.

The influence of turnip feeding on the fat content of milk, B. HOLTSMARK (*Tidsskr. norske Landbr., 4 (1897), pp. 161–169*).—The feeding of as much as 35 kg. (77 lbs.) of turnips per head per day, in connection with a liberal ration of concentrated feed (rye, shorts, rape-seed cake, and cotton-seed meal) and of cut straw, caused no decrease in the fat content of the herd milk, as compared with the feeding of the regular ration of hay, straw, concentrated feed, and a small quantity of roots. The turnips were fed whole.—F. W. WOLL.

Butter color, F. H. WERENSKIOLD (*Tidsskr. norske Landbr., 4 (1897), pp. 118–124*).

Influence of pasteurization on butter (*Nord. Mejeri Tidn., 11 (1896), p. 423*).

Loss in weight of butter on storing (*Nord. Mejeri Tidn., 11 (1896), pp. 413, 414*).

Scandinavian butter prices, 1896 (*Tidskr. Landtmän, 18 (1897), pp. 65–68*).

Water in Finnish butter (*Tidn. Mjölkhushållning, 5 (1896), p. 118*).—At the first periodical butter exhibition in Finland, held June 25, 1896, 54 samples of butter were received from 53 creameries. The average water content was 10.5 per cent, maximum 14.5 per cent, and minimum 8.5 per cent. The corresponding figures for 50 tubs exhibited August 7, 1896 (second butter exhibition), were 10.8, 13.8, and 8.5 per cent.

Finnish periodical butter exhibitions (*Tidn. Mjölkhushållning, 5 (1896), pp. 74, 78*).

Swedish butter exhibitions at Gothenburg (*Tidskr. Landtmän, 17 (1896), pp. 631, 632, 667, 668, 685, 686, 864–866*).—These are accounts of the thirty-first, thirty-second, thirty-third, thirty-fourth, thirty-fifth, and thirty-sixth butter exhibitions at Gothenburg.

Swedish butter exhibitions (Malmö) (*Tidskr. Landtmän, 17 (1896), pp. 649, 650, 703, 704, 828, 829, 848*).—These are accounts of the forty-second, forty-third, forty-fourth, and forty-fifth butter exhibitions at Malmö.

Moldy butter (*Nord. Mejeri Tidn., 11 (1896), pp. 495, 496, 581, 595*).

Creaming and churning experiments, H. HOLTE (*Nord. Mejeri Tidn., 11 (1896), pp. 544, 545*).

Systematic application of pure cultures in cheese factories, O. JOHANOLSEN (*Tidsskr. norske Landbr., 4 (1897), pp. 97–104*).

VETERINARY SCIENCE AND PRACTICE.

Combating anthrax in Delaware, A. T. NEALE (*Delaware Sta. Bul. 32, pp. 24*).—A summary is given of the experiences of the past five years with anthrax in the State of Delaware. The location of outbreaks, their alleged sources, the extent of losses, the precautions taken, the laws of Delaware relative to contagious diseases among the lower animals, the past and present position taken by this State relative to anthrax, and Delaware's condition in comparison with that of other States, are discussed. Then follow details relative to the outbreaks from 1892 to 1896, inclusive, the management of an epidemic, and, finally, comments on the results of inoculation experiments.

Every case of anthrax in the State since 1892 the author regards as belonging to one of the five distinct centers of contagion. All of these are included within a territory approximately 3 miles wide by 40 miles long, in a well-developed section frequently crossed by tide-water creeks or streams. These centers have all been found on fields bordering waterways and lowlands subject to tidal overflow on account of faulty sluices or broken dikes. When the disease spreads, it invariably passes upstream. To account for this the author adduces proof to show that carcasses of animals that have died of the disease are carried upstream by the incoming tide and that they finally ground and contaminate everything in their neighborhood. The carcasses are shown to have come originally from the New Jersey shore, where the disease evidently arises from germs brought in on skins used in a morocco factory. This assertion is supported by the fact that men working in the factory and engaged in counting and softening the raw skins have been attacked by anthrax.

It is pointed out that there is often considerable difficulty in obtaining the coöperation of farmers in eradicating the disease, notwithstanding the rigid laws upon the subject, but that where the operator shows evidence of protecting the owner of a herd by not giving undue publicity to the occurrence of the disease, and exhibits an evident endeavor to save him from unnecessary expense, there is a tendency to give the coöperation desired. He shows further that the laws of the State should be so modified that each animal destroyed shall be appraised and a bounty granted the owner which shall recompense him for his trouble in cremating or burying the carcass of the victim. He further states that the laws should be amended to include protective vaccination of exposed animals among the measures which the governor may take in combatting contagious diseases.

If these two measures are adopted, he thinks farmers will see the justice of the heavy penalty now prescribed against concealment and readily volunteer information.

Relative to the vaccination of susceptible animals and their safety after vaccination when turned upon infected pastures, the author states that the protection that has been credited to vaccination is a real one, although it may not be permanent. This is proven by the fact that vaccinated cows have been inoculated with anthrax poison without sickness following, while the same poison in precisely the same amount has been given at the same time to an unvaccinated cow with the result of its death within 72 hours afterwards. The good results of the work are shown by the fact that out of 19 herds vaccinated 17 escaped without loss, and that of 331 cows vaccinated only 2 died of anthrax.

Serum therapy in hog cholera, A. T. PETERS (*Nebraska Sta. Bul. 47, pp. 57–67*).—In a general way the author discusses antitoxin, and briefly notes the results of serum therapy in tuberculosis, rabies, pneumonia, enteric fever, typhus, cholera, syphilis, streptococcus infection, cancer, tetanus, diphtheria, snake bites, and swine erysipelas, in all of which good or promising results have been obtained. The work at the station is described and also a number of experiments. Of 1,176 hogs treated for cholera 659 were saved, or 56 per cent. The conclusion is drawn from the experiments that serum injected alone has only a limited power of immunity. Good results were obtained at the experiment station farm by injecting about 10 cc. of antitoxic serum to 1 cc. of virulent hog cholera culture, according to the weight of the animal.

On the immunity of the Gallinaceæ to human tuberculosis, LANNELONGUE and ARCHARD (*Compt. Rend., 124 (1897), No. 17, pp. 883-885*).—The author's observations partly confirm the general belief that gallinaceous birds are immune to human tuberculosis. He states that the bacilli inoculated into a fowl remain alive there and retain their virulence for a considerable time, sometimes several months, but their virulent period does not differ from that of bacilli that have not touched a fowl's body. To prove this last assertion he introduced bacilli sealed in a glass tube under the skin of fowls and of pigeons. Open tubes were also employed. The results were all the same. In conclusion the author says that the immunity seems to be due to loss of generative powers by the bacilli. The immunity, however, is only partial.

Tuberculosis in Maryland (*Nat. Stockman and Farmer, 21 (1897), No. 7, p. 8.*)—It is stated that the State sanitary live stock board has reports showing that 10,000 head of cattle have been examined in the State and that 1½ per cent were found infected.

On the actinomycosic form of the bacillus of tuberculosis, V. BABÈS and C. LEVADITI (*Compt. Rend., 124 (1897), No. 14, pp. 791-793*).—To the published statements of themselves and others the authors add that actinomycosis often recalls, especially in man, certain forms of abcesses or of osseous tuberculous lesions, and that actinomycosis reacts to tuberculin. The authors recall the various forms presented by actinomycosis and the bacilli of tuberculosis, and conclude that the latter must be placed in the same group as the former.

The present milk supply as an ally of tuberculosis (*Dietet. and Hyg. Gaz., 13 (1897), No. 6, pp. 352–355*).

Bovine tuberculosis in Finland, H. SAWELA (*Tidn. Mjölkhuskållning, 5 (1896), p. 34*).

Staining the tubercle bacillus in sections (*Pediatria, 1896, July 6, p. 38; abs. in Internat. Jour. Micros. and Nat. Sci., 3. ser., 7 (1897), No. 34, pp. 149, 150*).—Note is made of the use of hydrochlorate of anilin and alcohol for decolorizing sections stained with carbolized fuchsin.

Preparation of frozen sections by means of methyl and ethyl chlorid, H. W. CATTELL (*Internat. Med. Mag., 1896, Dec., pp. 706, 707; abs. in Internat. Jour. Micros. and Nat. Sci., 3. ser., 7 (1897), No. 34, pp. 187, 188*).—In this method tissues to be sectioned are prepared as in the method advised by Orth[1] in a mixture of Müller's fluid (1 part) and formol (10 parts), after which they are washed and dehydrated in alcohol. This is then removed or not used and the tissues frozen in formol and gum arabic by spraying with a mixture of methyl chlorid from above.

A rapid method of preparing permanent sections for microscopical diagnosis, L. PICK (*British Med. Jour., 1897, Jan. 16; abs. in Internat. Jour. Micros. and Nat. Sci., 3. ser., 7 (1897), No. 34, pp. 115, 116*).—Tissues are frozen and sectioned on an ether spray microtome. The sections are removed to a 4 per cent formalin solution, thence to a 4 per cent alum-carmine solution for 3 to 5 minutes. The sections are then rinsed in water and dehydrated by leaving for 15 seconds in 80 per cent alcohol and for the same length of time in absolute alcohol, after which they are placed in xylol-carbol and finally in Canada balsam.

The microbes in the air and water of Paris (*Rev. Scient., 4. ser., 7 (1897), No. 24, pp. 760, 761*).—Taking the information from the Annuaire de l'Observatoire municipal

[1] Berl. klin. Wochenschr., 33 (1896), No. 13.

de Montsouris for 1897 it is stated that according to Miquel on an average 7,620 bacteria are found in each cubic meter of Paris air, or 4,020 in winter and 9,685 in summer. In the air of sewers the average is 2,500 per cubic meter, and does not vary during the season. During January, 1895, the water of the Dhuys was strongly contaminated, containing 215,000 colonies per cubic meter. When breaks were made in the aqueduct, the number fell to the normal (1,635) soon after. Often the average is 4,050 per cubic centimeter, thus showing that it is not very pure.

Visceral lesions consequent upon burns (*Rev. Scient., 4. ser., 7 (1897), No. 20, p. 631*).—Note is made of an article by Baardeen in the April number of the Johns Hopkins Hospital Bulletin on the subject of the cause of such lesions and how they are produced. It is stated that an examination of the blood of animals burned experimentally has shown that the burning has developed toxic principles. These same principles are found in the urine of persons accidentally burned. Further, it is stated that these lesions are similar to those found in subjects that have died from acute infectious diseases.

Bacteriology and infectious diseases, E. M. CROOKSHANK (*London: H. K. Lewis, 1896, 4th ed., pp. XXX, 715, pls. 22, figs. 273*).—Methods of investigation, etc. The second part, comprising about 300 pages, is devoted almost wholly to diseases of animals. Anthrax receives considerable attention. A brief history of its spread since its discovery in 1849 by Pollender is given, as well as various tests for the identification of the organism.

Bacteriology and infective diseases, G. T. BROWN (*Jour. Roy. Agl. Soc. England, 3 ser., 8 (1897), No. 1, pp. 153, 154*).—A review of the fourth edition of Crookshank's work on this subject.

The more important diseases of swine: Their prevention and treatment, J. LAW (*pp. 27*).—A popular lecture presented before the New York State Board of Agriculture, January 15, 1896, and covering diseases of organs, constitutional diseases, parasitic diseases, and contagious diseases. The subject of swine plague is given considerable space, and is further brought out in the discussion that followed the lecture. Cases are noted where the flesh and even the limbs of diseased hogs fell off. The disease is shown to be largely traceable to the feeding of slops and refuse.

Immunity conferred by bleeding (*Rev. Scient., 4. ser., 7 (1897), No. 24, pp. 760*).—It is noted that a Russian physiologist, Essipov, has studied the effect of copious bleeding on the chemical composition and on the properties of the blood, and concluded that by bleeding (at the rate of $\frac{1}{35}$ to $\frac{1}{40}$ of the weight of the body) of rabbits, guineas, and pigeons, the blood of the animals acquires decided bactericidal powers, which are especially characteristic in the case of the cholera germ. The immunity becomes gradually established, reaching its maximum in about 24 hours. Then it decreases. Not only does the blood fail to form a culture medium for the bacteria, but the entire animal becomes for the time immune, becoming refractory even to inoculations. The immunity is more pronounced in cases of frequent bleeding.

The examination of blood in disease, R. C. CABOT (*London, New York, and Bombay: Longman's, Green & Co., 1897, pp. XIX, 405, ill.; rev. in Nature, 56 (1897), No. 1440, pp. 100, 101*).—The methods of chemical examination of blood are set forth, and an enormous amount of matter is arranged in a form for ready reference. It is the first book in English upon the subject.

Ascaris megalocephala as a cause of death, GRAEFE (*Deut. thierärztl. Wochenschr., 4 (1896), pp. 29, 30; abs. in Centr. Bl. Bakt. und Par., 1. Abt., 20 (1896), p. 932; Jour. Roy. Micros. Soc., 1897, No. 2, p. 126*).—*Post-mortem* examination of a 7-year-old horse that had suffered from cramps and progressive emaciation showed 2 *Ascaris megalocephalæ* that had perforated the walls of the intestine and caused peritonitis, and in the small intestine a couple of pailfuls of the worms.

Scab in sheep and goats, O. MYKLESTAD (*Tidsskr. norske Landbr., 3 (1896), pp. 333–338*).

Elimination of water and carbon anhydrid from the skin, W. BARRETT (*Jour. Physiol., 21 (1897), pp. 192–208; Proc. Physiol. Soc. [London], 1896–'97, pp. 10–12; abs. in Jour. Chem. Soc. [London], 71–72, No. 414, p. 219*).

Notes on Trematoda, P. MÜHLING (*Arch. Naturgesch., 62 (1896), pp. 243–299, pls. 4; abs. in Jour. Roy. Micros. Soc. [London], 1897, No. 2, pp. 127, 128*).—There are described *Distomum flexuosum* from the intestine of the mole, *D. longicauda* from the gall bladder of the gray crow, *D. hians* from the gullet of the white stork, *D. tenuicolle* from the liver of the gray seal, *D. cirratum* from the intestine of the carrion crow, *D. platyurum* n. sp. from *Harelda glacialis*, and *Cyathocotyle prussica* g. et. sp. n. from the same bird.

A cattle dip, W. W. WILLIAMS (*Jour. Jamaica Agr. Soc., 1 (1897), No. 3, pp. 119, 120*).—Describes an apparatus for the purpose of dipping cattle.

The malarial parasite and other pathogenic protozoa, G. M. STERNBERG (*Pop. Sci. Monthly, 50 (1897), No. 5, pp. 628–641, figs. 3*).—The presidential address delivered before the Biological Society of Washington, December 5, 1896.

The gape disease of fowls (*Amer. Agr. (middle ed.), 59 (1897), No. 22, p. 660*).—Advises feeding garlic mixed in a food of chopped hard-boiled eggs, beef heart, crumbs of stale bread, and salad.

Parasites of poultry, G. MCCARTHY (*North Carolina Sta. Bul. 131, pp. 265–276*).—This bulletin, the author states, was first prepared as a part of bulletin 127 on the parasites of domestic animals. It is compiled from the works of Fleming & Newman, and of Raillet, and from other sources, and forms a synoptical treatise upon the subject given in the title. Tapeworms, trematode worms, nematode worms, gapeworms, spiny headed worms, nest bugs, bird fleas and mites, leg mange, feather pulling itch mites, the various lice of chickens, turkeys, pigeons, geese, and ducks, and the cholera germ and the symptoms of disease produced by each are briefly described and the appropriate remedies noted.

Investigations into the cause of louping ill, R. G. SMITH (*Reprint from Veterinarian, 1897, May, pp. 14, figs. 4*).—A study of the subject was begun with the supposition that the disease is caused by a microörganism conveyed from the soil of infected districts by the sheep tick. Organisms were obtained from tick wounds on sheep that had died of the disease and grown in culture media. There were found *Micrococcus candicans*, *Staphylococcus cereus-albus*, an organism, α, recalling *Bacterium putidum*, and others, β and γ, that were allied to *Bacterium fluorescens*. Inoculation experiments were made with these, and pathogenic results obtained in some instances resembling features of louping ill, but no very conclusive results seem to have been obtained. A brief description of the tick is given.

Taenia bothrioplitis from the intestine of the fowl (*Arch. Path. Anat. u. Physiol. [Virchow], 144 (1897); abs. in Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897), pp. 35, 36; Jour. Roy. Micros, Soc. [London], 1897, No. 2, p. 128*).—The specimens were found in numerous small nodules in the serosa, the head being buried in the nodule. An examination of the gut in the neighborhood of the worm showed necrosis of the intestinal wall, and an infiltration of small cells and the presence of giant cells.

Helminthological notes, M. STOSSICH (*Bol. Soc. Adriat. Sci. Nat. Trieste, 27 (1896), pp. 121–136, 189–191, pls. 3; abs. in Jour. Roy. Micros. Soc. [London], 1897, No. 2, p. 127*).—The worm parasites in *Orthagoriscus mola*, *Pagellus erythrimus*, and *Falco subbutes*.

Investigations relative to combatting infectious animal diseases with peat litter treated with sulphuric acid, W. EBER (*Landw. Jahrb., 26 (1897), No. 1, pp. 191–200*).—Peat litter was treated with sulphuric acid, and used as bedding for swine and for milch cows. It does not give good results as bedding for swine, but in the case of the cows it seemed to have good effects.

Rabies (*Bd. Agr. [Great Britain] Leaflet 37, pp. 5*).—This makes mention of the various acts of Parliament relative to the subject, and cites the number of cases of rabies, etc., reported yearly since 1889.

On the locomotive action of the anterior limbs of the horse, P. LE HELLO (*Compt. Rend., 124 (1897), No. 17. pp. 913, 914, fig. 1*).—This describes and illustrates a mechanism to represent the motions of the legs, etc., of a moving horse.

AGRICULTURAL ENGINEERING.

Notes on irrigation, C. S. PHELPS and E. B. VOORHEES (*U. S. Dept. Agr., Office of Experiment Stations Bul. 36, pp. 64, figs. 7*).—The object of this bulletin is "to show the need and possibilities of irrigation in two representative Eastern States, the methods pursued and results obtained by farmers who have undertaken to practice irrigation in these States, and the problems needing investigation."

The article on irrigation in Connecticut, by C. S. Phelps, discusses the need, methods, and history of irrigation in Connecticut; describes 7 irrigation plants in successful operation in the State; gives an account of irrigation experiments undertaken under the auspices of the Storrs Experiment Station, and makes various suggestions regarding sources of water and means of making it available.

The article on irrigation in New Jersey, by E. B. Voorhees, discusses the need of irrigation in New Jersey, amount of water necessary, storage of water, seepage or return water, cost of irrigation, areas capable of being watered by gravity, irrigation by pumping and by wells, warping, water meadows, total area irrigable, estimated cost of irrigation and suggestions for small plants, and possibilities of pumping large quantities of water from wells for irrigating purposes; gives methods and results of practical trials on 5 farms in the State, and describes the irrigation experiments undertaken under the auspices of the New Jersey station.

These articles indicate quite clearly that supplemental irrigation is practicable and profitable under some conditions in these States. "It only remains to demonstrate by further study and experiment its adaptability to the varying conditions, in reference to crop and soil, the methods by which it may be most economically accomplished, and the advantages that may accrue therefrom, in order that a valuable resource of these States, namely, water supply, may be largely utilized in this direction."

STATISTICS—MISCELLANEOUS.

Agriculture in some of its relations with chemistry, F. H. STORER (*New York: Charles Scribner's Sons, 1897, vols. 3*).—This standard work has in large part been rewritten to incorporate recent advances in agricultural science. While the great value of the work is beyond question, it still must be a matter of regret to the student that a book so full of excellent digests of the results of the best scientific investigations of the world should not include a complete list of references to the original reports of these investigations.

Agriculture in the Sahara of Constantine, L. MARCASSIN (*Ann. Inst. Nat. Agron., Admin., Enseign, et Recherches, 16 (1891–'97), No. 14, pp. 191–299*).

Reports of treasurer and acting director of New York State Station, 1895 (*New York State Sta. Rpt. 1895, pp. 1–11, 230–243*).—This contains a financial statement for the year ending September 30, 1895, brief notes on the work of the station, list of bulletins, acknowledgments, etc.

The importance of coöperation in agriculture, especially as regards existing associations for the purchase of necessary articles, and for the manufacture or disposal of agricultural products, J. VON ENGESTROM (*K. landt. Akad. Handl. Tidskr., 36 (1897), pp. 3-76*).

Report of the Royal Swedish Agricultural Academy for 1896, C. LOVEN (*K. landt. Akad. Handl. Tidskr., 36 (1897), pp. 81-95*).

Agricultural statistics of Scotland for 1894 (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 7 (1895), pp. 405-422*).—A tabulated report giving the acreage under each kind of crop, bare fallow, and grass in each county, estimates of the total produce, the number of the various kinds of live stock, the amounts and values of imports, and the condition of the grain market for every market day in the year.

Agriculture in Skane, H. NATHORST (*Landbruket i Skane. Lund, 1896, pp. 109*).

On the amount of capital in Danish agriculture, and its division, T. WESTERMANN (*Ugeskr. Landm., 42 (1897), pp. 204-211*).

Danish agriculture, 1896, J. C. LA COUR (*Tidsskr. Landökon 16, (1896), pp. 1-37*).

Crops in Denmark, 1896, K. HANSEN (*Tidsskr. Landökon, 16 (1897), pp. 38-52*).

Danish agricultural exports and imports, 1895-'96, F. RECK (*Tidsskr. Landökön, 16 (1897), pp. 141-162*).

NOTES.

Idaho College and Station.—The position of agriculturist of the experiment station and college has been declared vacant. Warren Truitt, of Moscow, has been appointed a member of the governing board, and Frank E. Cornwall, of Moscow, has been made permanent secretary of the board of regents.

Iowa Station.—James Atkinson, of Guelph, Ontario, Canada, has been appointed agricultural assistant in the experiment station, *vice* C. D. Reed.

Maine Station.—Andrew J. Patten, of the University of Maine, has been appointed assistant chemist at the station.

North Carolina Station.—B. W. Kilgore, assistant chemist at the station, has accepted the position of State chemist and professor of chemistry in the Mississippi Agricultural College.

Wyoming College and Station.—F. P. Graves has been elected president of the university and director of the station for a term of 3 years. At the annual meeting of the board of trustees June 24, 3 of the substations were abandoned and provisions made for disposal of the land and sale of property at each place. The substation at Sheridan was given a small appropriation to continue the work there until the end of the present season. An appropriation was made for the substation at Lander to continue the fruit and stock feeding experiments at that place. Some improvements on the station farm were also provided for.

Alaska.—Benton Killin, member of the governing board of Oregon Agricultural College, and W. H. Evans, of this office, were appointed a commission to visit the coast of Alaska during the present season, paying especial attention to the vicinity of Cooks Inlet, Sitka, and Kadiak, and report upon the agricultural and horticultural possibilities of these regions. Collections of the native plants used for food and forage will be made and the desirability and feasibility of establishing an experiment station in the Territory will be investigated.

Rev. Dr. Sheldon Jackson has also been authorized to visit the region adjacent to the Yukon River, in Alaska, and collect information relative to climate, crops, soils, native fruits and plants, and other agricultural and horticultural statistics.

Necrology.—Carl Remigius Fresenius died June 11 at Wiesbaden in the eighty-seventh year of his age. Professor Fresenius studied at the Universities of Bonn and Giessen. After receiving his degree from the latter university he remained there as the assistant of Liebig and later as a privat docent. From Giessen he was called to Wiesbaden as professor of chemistry, physics, and technology at the Grand Ducal Agricultural Institute. In 1848 Fresenius founded his analytical laboratory in Wiesbaden, which has attained a world-wide reputation and attracted students from all countries. He was a prolific writer on chemical subjects, his best known works being "*Qualitative Analyse*" and "*Quantitative Analyse,*" which have passed through numerous editions and been translated into many languages. In 1862 he founded the *Zeitschrift für analytische Chemie,* which has been accorded a prominent place among journals devoted to investigations on analytical methods. In his earlier years Fresenius was especially interested in agricultural chemistry, and in 1847 published "*Lehrbuch der Chemie für Landwirthe, Forstmänner und Cameralisten,*" which was translated into Dutch and English. Fresenius received many honors and was a member of a large number of learned societies of Germany and other countries. Several years ago his son, Dr. Heinrich Fresenius, assumed the active direction of the analytical laboratory in Wiesbaden and the work will be continued along the lines laid down by its founder.

Prof. P. Schützenberger died June 28 in Paris, aged 67 years. He was a native of Strassburg and spent some years in teaching in that city. Afterwards he was assistant director of the Sorbonne Laboratory in Paris, head of the chemical department of the College of France, and since 1876 professor of chemistry in the latter institution. He was elected head of the Paris Municipal School of Chemistry and Physics, and was a fellow of the Academy of Medicine and of the Academy of Sciences. He contributed largely to the subject of organic chemistry and devoted especial attention, among other subjects, to digestion and fermentation.

Julius Sachs, the eminent botanist, was born at Breslau, October 2, 1832, and died at Würzburg, May 29, 1897. His first official post was privat docent at Prague. Later he was professor of botany at the Agricultural Institute at Poppelsdorf and afterwards at the University of Freiburg. In 1867 he was called to the professorship of botany at Würzburg, which position he held at the time of his death. He was one of the foremost of modern botanists as an investigator and teacher, especially in physiological botany, and a prolific writer on botanical subjects. His "Textbook" is recognized as a standard work, and embodies a great amount of original research.

Martin Wilckens was born at Hamburg in 1834, and died at Vienna in June, 1897. He devoted many years to the study of agriculture, and with the assistance of the Prussian Government made a large number of investigations, principally in the line of animal production. In 1872 he was called to Rostock as professor of agriculture, and later in the same year went to Vienna as professor of animal physiology and animal production in the Imperial Agricultural High School. He has published numerous works on agricultural topics, especially animal physiology and animal production, the most important of which is perhaps "*Grundriss der landwirthschaftlichen Haustierlehre,*" issued in two volumes in 1888–'89. In 1889 Professor Wilckens made an extended journey through the United States for the purpose of studying American agriculture, visiting many of the experiment stations. The results of this study are given in a book of 292 pages, published in 1890, entitled "*Nordamerikanische Landwirthschaft.*"

EXPERIMENT STATION RECORD.

Vol. IX. No. 2.

The abstract of an article on fattening calves (p. 169) is of special interest, since comparatively few investigations of this nature have been made. In discussions of the nutrition of a young calf Soxhlet, who published his work in 1878, is usually cited. He made an extended study of metabolism with three calves. The food and excretory products were carefully analyzed and the respiratory products were measured with a respiration apparatus of the Pettenkofer-Voit type. Soxhlet's experiments were reported in a publication of comparatively limited circulation, and are usually cited from more or less complete abstracts in more available journals.

Among the conclusions reached were that a sucking calf closely resembles a carnivorous animal in that its diet consists of animal food with an abundance of protein and fat, the time of digestion is short, and the food is almost completely digested. In the amount of nitrogen and carbon consumed the calf resembles a well-nourished carnivorous animal, and in the quantity of protein metabolized and not excreted it resembles a fasting carnivorous animal. The sucking calf was found to consume the same quantity of dry matter and one and a half times as much protein as a full-grown herbivorous animal (sheep) of the same weight with a very abundant diet—for instance, a fattening ration; but it metabolizes, *i. e.*, excretes, as little protein as an herbivorous animal on a maintenance ration. In the adult animal under all circumstances by far the larger part of the protein of the food is transformed into easily decomposable "circulating protein," but in the calf only a very small part. Also, in an adult animal the protein metabolized is at all times greater than the gain of protein, or, in other words, the larger part of the protein of the food is transformed into circulating protein and the smaller part into protein of tissue; in the sucking calf the reverse was found true, since the protein stored is always larger than the protein metabolized, two-thirds of the protein of the food becoming protein of tissue and one-third circulating protein. A very much greater quantity of mineral matter is retained by the sucking calf than by the adult animal.

From the results obtained in these experiments Soxhlet computed the food consumed and the metabolic balance for a calf two or three weeks old weighing 50 kg. In the frequent references to his results this calculated average is usually quoted instead of the results actually obtained.

While there is no reason for doubting Soxhlet's conclusions, it would be interesting to repeat the experiment and make others along similar lines. A considerable number of calf-feeding experiments have been made at the stations, but almost no work has been done on the metabolism of the calf.

The interesting investigations by Storch on the constitution of the fat globules of cow's milk, noticed in this number of the Record, revive the old and now generally discarded membrane theory. The author believes he has proved the existence of a slimy albuminous membrane around the fat globules. He has studied the subject in a somewhat different way from others. The conclusions appear to be borne out by a large amount of carefully executed work. But the behavior of artificial emulsions, as, for instance, of fluid butter fat or oil with skim milk, under conditions similar to those to which the milk was subjected was not studied. Many scientists will hesitate to accept the theory advanced until it has been shown that there are specific differences between the action of the fat globules of milk and the fine globules of artificial emulsions. This would furnish an interesting theme for further investigation.

THE AIMS AND TENDENCIES OF THE GERMAN AGRICULTURAL EXPERIMENT STATIONS.

Prof. M. Maercker, Ph. D.,
Director of the Agricultural Experiment Station at Halle, Germany.

The German agricultural experiment stations have developed from small beginnings as a result of the need which was felt for such institutions. They were not originally established by the State, with large revenues, but were founded with only small means by agricultural societies, which hoped thereby to advance the cause of agriculture in its various phases.

In Germany we are indebted for the development of scientific agriculture to Justus von Liebig, whose teachings early became popular with the practical farmers and found extensive application, although not always with the result anticipated. This instead of discouraging agriculturists stimulated them to make a thorough study of the questions involved and to investigate the conditions under which Liebig's theory of manuring led to disappointing results.

The large majority of German agriculturists never doubted the correctness of Liebig's mineral theory of plant nutrition, but the many cases of failure gave rise to a demand for some institution which should determine the conditions under which the theory would lead to a certain result. This institution was found in the agricultural experiment stations; and it is an indication of the object of the agricultural experiment stations, established by German agriculture, that from the first the solution of everyday practical questions has not been expected of the stations, but rather scientific investigation and demonstration of the principles of agriculture. The very modest means which agricultural societies and private persons were able to provide for this purpose did not suffice, and it was not until the State and provincial governments, appreciating the importance of the experiment stations for the development and improvement of agriculture, came to their assistance with the necessary financial support that the stations were able to conduct their work in a satisfactory manner.

Originally the principal investigations of the experiment stations were on soils and mineral fertilizers. But very soon exact studies on feeding stuffs and animal nutrition were added, which in the fifties and sixties resulted in very important contributions to the subject.

It must be admitted that some of the expectations of practical agriculturists could not be immediately realized by the experiment stations, because they were entering upon a hitherto unoccupied field of scientific research and must first work out the scientific principles underlying agriculture by long, tedious investigations, which were not always of direct benefit to the farmer. For instance, it was seldom possible from simple chemical analysis of the soil to draw a reliable conclusion as to the fertilizer requirements of the soil. In some respects the analysis was deceptive, for it showed the total amount of fertilizing ingredients in the soil, but did not show the degree of their solubility. Hence it became necessary to determine the fertilizer requirements of different cultivated plants by means of tedious, purely scientific investigations before it was possible to prescribe working rules for fertilizing crops. This determination of the fertilizer requirements of crops formed the principal work of many stations for two decades, with the collaboration of such eminent scientists as Sachs, Knop, Nobbe, Hellriegel, and others. As a result these fundamental principles are now known, and this furnishes convincing evidence of the great usefulness of the experiment stations to the practice of agriculture.

Besides the scientific work, which formed the principal aim of most of the stations, it became necessary, in the interest of practical farmers, for the stations to undertake the examination of various agricultural supplies, such as artificial fertilizers, concentrated feeding stuffs, and seeds. As this work was supported by a regular tariff, in some cases it became a source of considerable income, which could be used in carrying on scientific investigations.

Within the past decade there has been something of a reaction against this custom of tariff. The view is becoming prevalent that the dealers in fertilizers and feeding stuffs should not be required to contribute to the support of the experiment stations by the payment of a tariff for analyses of their goods. There is no ground for the allegation that the experiment stations, by drawing a part of their income from the dealers in fertilizers and feeding stuffs, are placed under any obligations to these dealers, for the experiment stations have always carried on this work in a scientific and impartial manner. But it is rightfully held that it places the experiment stations in an undignified and somewhat embarrassing position, in that they are not independent, but must look to the dealers and the industries quite largely for their support. Accordingly the appropriations for the experiment stations from the State and the province have been increased, so that the stations have become, as they should be, entirely independent.

In the present status of the experiment-station movement it may be difficult to understand this condition in other countries, but it is explained on the ground that the German experiment stations, as stated at the beginning of this article, are not federal but private institutions with limited means.

We will now consider the separate branches of the work of the stations and the tendencies which have been apparent.

CONTROL WORK OF THE EXPERIMENT STATIONS.

The fertilizer control.—At the beginning of trade in commercial fertilizers the fertilizer control consisted of a so-called warehouse control. The dealer in artificial fertilizers stored his supply in a warehouse and sold from this warehouse to the farmers in his vicinity. The experiment station in that locality entered into an agreement with the dealer, by which the station representative was allowed to enter the warehouse at any time and take samples for analysis and the station received a lump sum for this control. Furthermore, each purchaser of commercial fertilizers from this dealer was entitled to an analysis at the station free of charge, and it was this that gave the farmer safety in buying fertilizers. But the fact that the experiment stations constantly controlled the stock of the dealers gave the farmers a certain feeling of confidence, so that in most cases they soon omitted having the control analyses made. This naturally opened the way to dishonest dealers and defeated the purpose of the control. The result was that the control was disregarded, and farmers selected dealers who had the best reputation for honesty. Latterly the warehouse control has been given up. This had ceased to be of importance, as the dealers now rarely warehouse their goods. But the stations did not withdraw entirely from control contracts with fertilizer manufacturers and fertilizer dealers. These contracts retained the right of the farmer who bought goods of the respective dealers and manufacturers to have analyses of the fertilizers made free, and the dealers agreed to accept as binding the analysis of the agricultural experiment station. The dealers pay a stipulated tariff for the analyses to the station or the agricultural board which established the station. This tariff is sufficient to cover only the cost of making the analysis. Hence the experiment stations receive no subsidy from the fertilizer manufacturers or dealers, and are consequently entirely independent. Such a control might be held to be superfluous, as without it the farmer could have the goods he buys analyzed at any experiment station, if he wished. If, however, the farmer is entitled to an analysis free of charge, he will avail himself of it more frequently, and the control will therefore protect the small farmers. The expense of analysis would be too great for the small farmers, who buy only small amounts of fertilizer.

It is due to the efforts of the experiment stations that the trade in commercial fertilizers has been placed on a comparatively solid basis, by which fertilizers are everywhere sold on their content of valuable constituents. In selling fertilizers in Germany a guaranty is given of the percentage of water-soluble, citrate-soluble, and total phosphoric acid; of nitrogen in the forms of nitrate or ammonia, and of potash, lime, or other constituents. Special mixed fertilizers, under the general name of wheat fertilizer, beet fertilizer, grass fertilizer, etc., which were formerly common, are now unknown in Germany. Under the guidance of the experiment stations the German farmer has reached the point where he prepares his own mixed fertilizers for special purposes from the separate constituents. This is the rational method, for a general fertilizer mixture which may be well suited for one purpose is absolutely unfitted for another. An ordinary mixed fertilizer which, for instance, furnishes the phosphoric acid indicated for wheat, when used on a soil rich in phosphoric acid would be a great waste of phosphoric acid, but on a soil poor in phosphoric acid would furnish too little of that ingredient.

An idea of the extent of the control work of the experiment stations in Germany in recent years may be gained from the following statement. It is a matter of regret that there are no compiled statistics except for the Prussian stations, from which the following figures are taken. Thirty experiment stations in Prussia examined—

Samples of agricultural supplies.

In 1892	58,268
In 1893	70,682
In 1894	102,176

There are in Germany 50 agricultural experiment stations, and if we assume that the activity of those outside of Prussia is equivalent to that of the Prussian stations we get the following totals and averages:

In 1892, 97,133 samples, or 1,943 per station.
In 1893, 117,803 samples, or 2,356 per station.
In 1894, 170,293 samples, or 3,406 per station.

Of these examinations, about 52,000 were of commercial fertilizers. It will be seen from these figures to what an extent the control has increased from year to year. Between 1892 and 1894 it nearly doubled, and it is to be expected that in the next few years there will be a still greater increase in the number of examinations.

It might be thought that there is no necessity for the passage of laws in Germany against the adulteration of fertilizers and feeding stuffs, such as have been enacted in Belgium, France, England, and the United States of America, but such is not the case. With the enormous extent of the trade in commercial fertilizers and concentrated feeding stuffs, only a certain part is controlled under the present conditions, and the small farmers especially are largely deprived of the advantages of a fertilizer and feeding stuffs control. For the protection of the interests of this class of farmers a law should be passed in Germany to regulate the trade in fertilizers and feeding stuffs. This is especially necessary to the farmer in the present state of agricultural depression.

The control work in the interest of the practical farmers will always remain a very important part of the work of the agricultural experiment stations, although the scientific work of the experiment stations should by no means be subordinated to this. With the enormous annual increase in this control of fertilizers and feeding stuffs, it is apparent that the control work and scientific investigation can not remain permanently united; for in time the control will reach such proportions that the strength of one man will be insufficient to direct both branches. Accordingly in the case of several German stations the control work has already been separated from the scientific work, forming an independent division. Examples of this are Göttingen, Halle, and Moeckern. This course will probably be followed by most of the experiment stations in the future. These divisions might be made independent control stations, to which should fall only the examination of agricultural supplies; but their connection with scientific agricultural experiment stations has so many advantages that it is assuredly to be preferred. When, for instance, the assistants in a control station are required to make the same determinations year after year in a mechanical manner, this monotonous work will tend unavoidably to cripple their mental perception and acuteness, while the assistants connected with a scientific experiment station have a variety of work and can take an active part in the scientific promotion of agriculture. Their field of observation thereby becomes broader and their fondness for the work increases.

The feeding stuffs control.—This is carried on similarly to the fertilizer control and has met with the same success. But it required greater efforts on the part of the agricultural experiment stations to get the trade in feeding stuffs upon a proper basis. While the dealers and manufacturers of fertilizers were quick to offer a guaranty for the valuable constituents of their goods (nitrogen, phosphoric acid, potash, etc.), this was obtained for the concentrated feeding stuffs only after a long contest. It must be acknowledged that not nearly all has been accomplished for the trade in feeding stuffs that is to be desired. About six years ago the agricultural experiment stations carried their point, requiring that concentrated feeding stuffs rich in protein and fat, *e. g.*, cotton-seed meal, peanut meal, rape cake, and similar oil cakes, should be bought and sold on a guarantied content of protein and fat, and that on the basis of the analysis the farmer should receive an indemnity for any deficiency in the percentage of these two constituents. In the case of other feeding stuffs, as wheat bran and rye bran, it has not been possible to secure such an arrangement and the trade in these important feeding stuffs is at present attended with great uncertainty. In general adulteration and contamination of feeding stuffs is much more common than of commercial fertilizers. In the case of the latter, as mentioned above, the provisions are such as to insure comparative safety. Along this line the experiment stations have a hard battle to fight with the dealers, and at the present time the most difficult part of the control work of the stations has to do with concentrated feeding stuffs rather than with commercial fertilizers. That in the end the result will be satisfactory is not to be doubted; but it will require all the energy of the experiment stations in coöperation with the practical farmers to put the matter on the proper basis.

The seed control.—This branch of the control is comparatively new and is not exercised by all of the experiment stations in Germany. As it is more botanical than chemical, it is in its details outside of the scope of agricultural chemists. Consequently as soon as the seed control had assumed considerable proportions there was a general tendency to assign it to a separate division of the experiment stations or to special seed-control stations.

The union of the seed-control stations, with the agricultural-chemical experiment stations is not as necessary as in the case of the fertilizer and feeding stuffs control. The director and assistants in the seed-control station are not chemists but botanists, and hence are not intimately associated with the other work of the agricultural experiment station. On this account, there are many independent seed-control stations in Germany, for instance, at Tharand, Kiel, and Breslau, among others; and there are also several independent botanical divisions of experiment stations, as at Halle, Moeckern, etc.

The seed control, like the control of fertilizers and feeding stuffs, increases from year to year. This is very desirable, as previous to the introduction of the seed control there was great risk in buying seeds. In Germany Professor Nobbe, of Tharand, deserves to be called the father of this highly beneficial branch of station work.

Control of dairy products.—This branch of the work of the agricultural experiment stations is an entirely new one. The progress made in the field of dairying has compelled the farmers to coöperate with each other in the manufacture of dairy products and in disposing of them. The incentive to this came through the invention of the centrifugal separator, which made it possible to handle almost any amount of milk in a creamery and to make butter cheaper than the farmer could do it. Moreover, in Germany the requirements as to the quality of butter have increased to such an extent that a small farmer who is not in a position to make a uniformly good butter, year in and year out, can not fulfill them. To this was added the competition of oleomargarin with butter, and the adulteration of butter with margarin, which necessitated the strictest possible control of the trade in butter in order to stamp out as far as posible fraudulent trade in oleomargarin. Unfortunately, it must be acknowledged, this competition is by no means suppressed to the extent that it should be. In spite of the private control, a legal regulation with severe penalties has been shown to be absolutely necessary.

These conditions showed the necessity of providing suitable agencies for the protection of the dairy interests, which was met in part by establishing dairy divisions in the agricultural experiment stations and in part by establishing special dairy experiment stations. These not only exercise a control over the dairy products but also work for the promotion of the science of dairying. Bacteriology has found an important place in connection with this dairy work and may be expected to solve many problems in this field.

The control work in dairy lines extends in various directions. Where numerous farmers supply milk to a creamery for butter making, it is obvious that every farmer should be paid on the basis of the fat content of the milk furnished by him. Consequently the payment for milk according to its fat content has become quite general and the majority of creameries, for instance, in Schleswig-Holstein and the Prussian Province of Saxony, have their milk tested for fat regularly at the dairy experiment stations or dairy divisions. For this purpose each creamery on certain days takes small samples of the milk brought by each patron and sends these samples to the experiment station for analysis.

The dairy division of the experiment station at Halle made in this way some 20,000 analyses of milk for fat during the past year, and the number will probably increase to 30,000 the present year. The test is made by Wollny's refractrometer method, which has been found to be the best for examination on a large scale.

The examination of samples of butter for adulteration, etc., also naturally falls to the dairy experiment station. As this dairy work has as yet assumed considerable proportions in only a few States in Germany, it is safe to predict that the near future will bring a great increase in the work required of the experiment stations, which in the nature of the case they can not neglect to take up.

STUDIES OF THE FERTILIZER REQUIREMENTS OF THE SOIL.

The agricultural experiment stations must by their analytical work determine for the farmer the condition of his soil as to the fertilizing ingredients it contains and its fertilizer requirements.

It was a long time before the agricultural experiment stations could do work in this field which was directly beneficial. It was first necessary to settle many preliminary questions before advice could be given with some degree of certainty as to the result. For a time too much was expected of the chemical examination and too great stress was laid on the composition of the soil. It is true that the productiveness of the soil depends upon the presence of certain quantities of definite constituents, which are determined by chemical analysis, but without certain physical properties a soil with the best conditions as to fertilizer constituents can not be relied upon to show satisfactory productiveness. Consequentiy, it very soon became necessary for the agricultural experiment stations to elaborate methods for the physical examination of soils as well as for chemical analysis; and on this problem the experiment stations are still industriously working to-day.

It has long been known that the physical properties of cultivated soils are of equal importance with the chemical composition, and no agricultural chemist would to-day take exception to this. Often chemical and physical problems are closely connected with each other. An example of this is the lime question, which is at present the important question relating to soils. In this very matter one-sided chemical investigation was decidedly detrimental and for a time delayed the development of agriculture. By chemical analysis fully as much lime was found in many soils as phosphoric acid, potash, and other plant nutrients, and the conclusion was reached that manuring with lime was no more necessary than manuring with other ingredients. This conclusion was far from correct, and it was found in the course of time that the lime question was for the larger part of the soils of Germany the all-important one, inasmuch as lime is not only an essential plant nutrient, but is also of the greatest importance in connection with the physical properties and the changes taking place in the soil. As an instance of this it may be mentioned that the system of potash manuring tested in Germany by Schultz-Lupitz first showed superior results when the potash manuring in sandy and heavy soils was accompanied by a sufficient application of lime. Most of the directions for fertilizing soils which did not actually show a large excess of lime became fully effective only when the soil was given a good dressing of lime. The promotion of our knowledge in regard to lime is at present one of the most important problems before the agricultural experiment stations, and has been taken up on a large scale in Germany. Fortunately the poverty of a soil in lime can be determined with accuracy by chemical analysis and by determining the different forms in which the lime is present.

Although in some respects soil analysis leaves much to be desired, it is reliable in studying the lime question, so that it is only necessary to make an examination of a soil to determine whether or not it is deficient in lime. To this end most of the agricultural experiment stations have already made extensive investigations on the lime content of soils, and where a deficiency in lime has been found the region has been searched for deposits of lime and marl to correct this deficiency. The results which have followed this line of station work in most parts of Germany have been of the highest value.

For other purposes soil analysis is comparatively seldom required of the stations. For ascertaining the nitrogen requirements of the soil, for instance, soil analysis is almost never resorted to, for it is known that with the exception of certain peaty soils all cultivated agricultural soils in Germany show a pronounced deficiency in nitrogen, so that the use of nitrogenous fertilizers in Germany is very general.

A more important question which, however, has not yet been solved, is the determination of the need of soils for phosphoric acid. Simple chemical analysis is for this purpose almost useless, although when only a trace of phosphoric acid is found in a soil it is of course very evident that the soil needs phosphoric acid. But when chemical analysis shows the soil to be rich in phosphoric acid it is by no means certain that the soil may not need phosphoric acid badly. The phosphoric acid in such a soil may be in very insoluble form, and so render heavy manuring with phosphoric acid necessary. This feeling of uncertainty as to the requirements of the soil for phosphoric acid leads farmers to apply an excess of phosphoric acid in order to be on the safe side. Consequently there is without doubt often a great waste of phosphoric acid in Germany, representing a large cost to farmers. Hence it becomes a very important function of the agricultural experiment stations to elaborate a method by which the degree of solubility or availability of the phosphoric acid in the soil can be accurately estimated in order to determine whether phosphoric acid is really required, and if so whether a light or heavy application is called for.

As compared with the determination of phosphoric acid, chemical soil analysis is more reliable in the case of potash in showing the amount available; although in this case chemical analysis is really unnecessary as it may be replaced by physical analysis. If it is found by the physical-mechanical analysis that a soil has a large amount of dust-like fine earth, it can be concluded with certainty that the soil does not require heavy applications of potash. The fine earth separated by the elutriator consists as a rule of large quantities of residues of potash-containing rocks; and only a soil poor in fine earth will show poverty in potash. Hence chemical analysis has only a small application in this field, as it can be easily and accurately determined by other means whether or not a soil is in need of potash fertilizers.

RELATIONS OF THE STATIONS TO THE FARMERS AND TO THE IMPROVEMENT OF FARM PRACTICE.

The experiment stations should advise the farmers on all general questions, and should give to practice the necessary basis for a rational farm management.

A broad field is here presented to the agricultural experiment stations, from which only a few examples will be cited.

The feeding of farm animals is at present far from being understood, and the practical farmers have by no means applied the investigations of the experiment stations in this line to the same extent that they have those in the fertilizing of crops. This is true in spite of the fact that the rational nutrition of farm animals is equally as important to agricultural production as the rational use of fertilizers. The experiment stations are in a position to assist the farmers to feed in a more rational manner, and on the basis of investigations in animal nutrition rations can be calculated with comparative certainty as to the result which will follow their use, often with much more certainty and reliability than in the case of questions of manuring, in which many uncertain factors enter whose effect can not be estimated.

A profitable line of work for the experiment stations is therefore the collection of information from farmers on the methods of feeding which they follow; and on the basis of this it will be found in many cases that the principles of rational feeding are imperfectly understood. In place of the faulty rations employed by them, which in some cases will be found insufficient, in others wasteful, and in others one-sided, new rations should be calculated and recommended to the farmers.

The writer can speak in this matter from personal experience as he is called upon to calculate from 500 to 600 rations for farmers annually. Where the advice given has been followed, favorable results have been obtained in every case. As a result of using the rations calculated by the Halle Experiment Station, the milk production, for instance, has in some cases been increased 1½ liters per cow daily without materially increasing the cost of the ration. The usefulness of this work led the Prussian Government to recommend all the larger experiment stations to take it up; and the calculation of feeding rations at present constitutes a part of the regular work of most of the stations.

A similar line of activity is open to the experiment stations in studying the practice in using fertilizers. The agricultural depression makes it important to investigate the means by which agricultural production can be cheapened, and in this a rational use of commercial fertilizers is of first importance. The benefits to be derived from artificial fertilizers were first learned on a broad scale in Germany; but the results of trials of guano, Chile saltpeter, and phosphates led to an extravagant use of them. With the former high prices of agricultural products the expense of this could be borne, but with the present prices wasteful practice in the use of fertilizers must be guarded against. Hence it becomes necessary for the experiment stations to investigate to what extent and with what crops the excessive use of fertilizers is practiced, and to prescribe means for its correction.

On the other hand, a diminution in the use of commercial fertilizers is by no means to be recommended in all cases. There are extensive regions in Germany where comparatively little commercial fertilizer is used, and this is true in the regions where the soils are especially responsive to fertilizers. Among the latter are principally the sandy soils, on which we have learned to produce surprisingly large crops with the aid of commercial fertilizers. In the trials by Schultz-Lupitz of potash salts in connection with the cultivation of nitrogen-gathering plants, the yield of sandy soils was increased one-third on the average, and the cost of production thereby materially cheapened.

The amount of potash salts used has increased from 30,000,000 lbs. in 1882 to over 400,000,000 lbs. in 1895; but it is calculated that if an adequate amount of potash were applied to all the soils which require potash the annual consumption of these materials would amount to some 1,700,000,000 lbs. It is an important matter for the experiment stations to encourage this use of potash salts wherever potash is indicated as needed.

The case is similar with lime. Lime is the basis of all culture and of successful farming, and the effective use of commercial fertilizers in soils deficient in lime is entirely out of the question. Therefore it is the duty of the experiment stations to determine the localities where lime is deficient, and to urge that liming be practiced much more extensively than formerly. They should not rest until this question is solved to the advantage of agricultural production.

Another field of practical work for the experiment stations is the introduction of species of agricultural plants especially adapted to the climate and soil conditions. The farmer is very conservative in this respect, and is induced with difficulty to cultivate a new species. The agricultural experiment stations should make the necessary studies in this line, and on the basis of these should recommend to the farmer the kinds to be grown and endeavor to bring about their cultivation.

Another branch of the advisory work of the stations relates to the injuries to plants, which in Germany, as elsewhere, have increased more and more in recent years. This naturally includes advice in regard to the injuries to agricultural plants by industries.

[Concluded in next number.]

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The determination of citrate-soluble phosphoric acid in Thomas slag, O. Böttcher (*Chem. Ztg., 21 (1897), No. 19, pp. 168, 169*).—A brief statement of Wagner's method for the determination of citrate-soluble phosphoric acid in Thomas slag is followed by a description of several proposed substitutes, which are claimed to be simpler and equally reliable.

(1) Dissolve 5 gm. of the slag in ammonium citrate according to Wagner. To 50 cc. of this citrate solution in a platinum dish add a spoonful of nitrate of soda, evaporate to dryness, incinerate, moisten with hydrochloric acid, and dry for 2 hours to render the silica insoluble. Dissolve the residue in hydrochloric acid with the aid of heat, dilute with water, filter, wash with hot water, and in the filtrate determine the phosphoric acid by the citrate method.

(2) In 50 cc. of the Wagner citrate solution of slag, precipitate the phosphoric acid directly by the citrate method, filter through a paper filter, wash with 5 per cent ammonia water, incinerate the moist filter in a platinum crucible. Dissolve the ash in hydrochloric acid with the aid of heat, filter, wash with hot water, and determine the phosphoric acid in the filtrate by the citrate method.

(3) Instead of incinerating the moist filter above, dry at 120° and then proceed as directed.

It has been objected that in this modified citrate method the pyrophosphate is not completely reconverted into the orthophosphate and hence low results are obtained. The untenableness of this is shown by the fact that (2) and (3) give concordant results, while one does and the other does not contain the pyrophosphate to be reconverted during the process. To further disprove the validity of the objection a given weight of the pyrophosphate was dissolved in hydrochloric acid and made up to 500 cc. The phosphoric acid was determined by the citrate method, in some portions directly, in others after boiling with fuming nitric acid. The results in the two cases agreed closely.

As a result of his researches the author concludes that the ordinary citrate method, as applied in the determination of water soluble and total phosphoric acid in other fertilizers, need not be modified in order to determine citrate soluble phosphoric acid in Thomas slag.—J. T. ANDERSON.

Investigations on arabinose, BERTHELOT and ANDRÉ (*Compt. Rend. Acad. Sci. Paris, 123 (1896), p. 625*).—The pentoses are characterized by their easy conversion into furfurol. This reaction takes place with scarcely any absorption of heat. Both arabinose and furfurol are endothermic compounds with almost identical heat absorption. The authors investigated the action of water and acids of varying concentration on furfurol and arabinose both in the closed tube and with distillation of the volatile products. They determined humus substance, furfurol, formic acid, and carbon dioxid, and conclude that with acids arabinose exhibits three reactions: (1) The formation of furfurol. This distinguishes the pentoses from the glucoses. (2) The formation of humic acid. Considerable quantities are formed when the operation is conducted in a closed vessel. Concentrated acids convert almost all the carbon of both sugars into humic acid. (3) The slow formation of carbon dioxid. This is a new property common to both pentoses and glucoses.—W. H. KRUG.

The decomposition of carbohydrates by alkalies, F. FRAMM (*Arch. gesam. Physiol.* [*Pflüger*], *64 (1896), No. 1, p. 575; Chem. Centr. Bl., 1896, II, No. 17, p. 824*).—The intensity of the color obtained by the action of alkalies on carbohydrates in Moore's test depends on the temperature and the amount of alkali. Light is without influence, but the coloration is prevented by passing air or oxygen through the alkaline sugar solution, provided the temperature does not rise above 45°. (1) δ-Glucose. Addition of air hastens the reaction with the formation of formic acid and aldehyde. (2) Galactose. The reaction is hastened by the oxygen, much formic acid being formed. (3) δ-Fructose. The influence of the atmospheric oxygen is much more energetic, and formic acid is the sole product of oxidation. It is worthy of notice that lactic acid was never found among the products of oxidation when air was present, while it is always produced in its absence.—W. H. KRUG.

The progress of agricultural chemistry during the last 25 years, M. MAERCKER (*Ber. deut. chem. Gesell., 30 (1897), p. 464; Neue Ztschr. Rübenz. Ind., 38 (1897), Nos. 14, pp. 153–156; 15, pp. 165–168*).

On the constitution of phosphorous acid, A. MICHAELIS and T. BECKER (*Ber. deut. chem. Gesell., 30 (1897), No. 8, pp. 1003–1009*).

On the occurrence and identification of iodin in hair, W. HOWALD (*Ztschr. physiol. Chem., 23, No. 3, pp. 209–225*).

To what are the poisonous properties of wall papers due? B. GOSIO and O. EMMERLING (*Ber. deut. chem. Gesell., 30 (1897), No. 8, pp. 1024–1026*).

The carbohydrate group in the protein molecule, N. KRAWKOW (*Arch. gesam. Physiol.* [*Pflüger*], *65 (1897), No. 5–6, pp. 281–298*).

On the source and occurrence of levulose in manufactured products, H. C. GEERLIGS (*Med. Proefsta. Suikerriet West Java, No. 29, pp. 37; reprint from Arch. Java Suikerind., 1897, No. 7*).

On the preparation of artificial starch grains or spherocrystals, O. BUTSCHLI (*Verhandl. natur. med. Ver. Heidelberg., n. ser., 5 (1897), No. 5, pp. 457–472*).

On the determination in the wet way of carbon and nitrogen in organic substances, P. FRETSCH (*Ann. Chem. u. Phys., 294, pp. 79–88*).

The quantitative estimation of nitrates and nitrous acid, B. GRÜTZNER (*Arch. Pharm., 235 (1897), No. 4, pp. 241–245*).

An automatic titration apparatus, PETERS and ROST (*Chem. Ztg., 21 (1897), No. 36, p. 351, fig. 1*).—The vessel intended to hold the standard liquid resembles a Wolff's flask with 3 necks, through one of which the burette stem enters, through another the overflow tube, and to the third a rubber bulb is attached. The distinguishing feature of this burette is the bulb at the top, which serves as an overflow attachment, and the tube connecting this bulb with the supply flask. Pressure on the rubber bulb fills the burette to the overflow, then when the overflow tube is opened the excess of liquid runs back into the supply flask, leaving the column of liquid in the burette standing exactly at zero.—J. T. ANDERSON.

A small vacuum apparatus, HAUSSMAN (*Chem. Ztg., 21 (1897), No. 36, p. 352, fig. 1*).—The evaporating vessel consists of a porcelain cylinder with the upper rim flanged, to which closely fits a glass funnel, provided with a T-tube and connected thereby with an exhaust pump. The cylinder is made to fit into an ordinary water bath.—J. T. ANDERSON.

A new wash bottle with stopcock and ventilating closure for the prevention of evaporation and fouling of the wash liquid, M. STUHL (*Chem. Ztg., 21 (1897), No. 40, p. 396, fig. 1*).—The apparatus is in two pieces, the flask with the attached mouth tube in one and the stopper and delivery tube in the other. In the side of the hollow-ground stopper is a hole, which when opposite the mouth tube allows communication with the interior of the flask. A slight turn of the delivery tube closes the flask securely.—J. T. ANDERSON.

A stirrer for laboratories, A. PRAGER (*Chem. Ztg., 21 (1897), No. 38, p. 379, fig. 1*).—A horizontal shaft, arranged for either hand or machine power, carries any desired number of conical cogwheels. These work into other conical cogwheels whose axes are vertical and carry clamps for holding the stirring rods.—J. T. ANDERSON.

A stirring machine for laboratories, A. PRAGER (*Chem. Ztg., 21 (1897), No. 38, p. 379, fig. 1*).

An outline of the theory of solution and its results, J. L. R. MORGAN (*New York: John Wiley & Sons. London: Chapman & Hill, 1897, pp. 63*).

The principles of mathematical chemistry, G. HELM (*New York: John Wiley & Sons. London: Chapman & Hill, 1897, pp. 228, figs. 17*).—Translated from the German by J. L. R. Morgan.

Handbook for the bio-chemical laboratory, J. A. MANDEL (*New York: J. Wiley & Sons. London: Chapman & Hart, 1896, pp. 101*).—Methods of preparation and tests for a number of compounds.

BOTANY.

On the action of light on diastase and its biological significance, J. R. GREEN (*Proc. Roy. Soc. [London], 61 (1897), No. 369, pp. 25–28*).—This is an abstract of a paper read before the Royal Society February 25, 1897. The author was led to undertake the experiments upon which this paper is founded by the statements of Brown and Morris that the quantity of diastase in foliage leaves undergoes considerable variation during the 24 hours of the day, being greatest in the early morning and lowest in the evening, particularly after several hours of sunshine. The experiments of the author were carried out during the past three years to ascertain whether the diminution in the quantity is due to a destructive influence of the light upon the enzym similar to that which has been observed upon the life of microörganisms and other low forms of vegetation.

The method of investigation was to expose various solutions containing diastase to the action of light for several hours, and after such exposure to test their hydrolyzing power upon a weak solution of soluble starch or upon a 1 per cent starch paste. The diastatic solutions used were extract of malt, solution of diastase precipitated from malt extract by alcohol, dilute saliva free from mucin, and extract of foliage leaves. The source of illumination was either bright sunshine, diffused light, or naked electric arc light.

From repeated experiments it was found that exposure to the whole spectrum for several hours caused the destruction of from 20 to 60 per cent of the diastase. When the ultra-violet rays were cut off by the intervention of glass, at first there was a considerable increase of the diastase, but this was succeeded on a longer exposure, lasting for several days, by a gradual and almost complete destruction of the enzym. By the use of a series of screens the visible spectrum was divided off and the effects of the different regions tested, the details of the experiments being given in the complete paper. It was found that the infra-red, red, orange, and blue regions gave an increase of 10.8, 53.5, 4.75, and 20.8 per cent, respectively, and the green a diminution of 15.7 per cent. The effect of illumination upon diastase was found to be progressive, the increase or diminution continuing after the solutions were removed from the influence of the light. The screening influence of proteids was examined by adding small quantities of egg albumen to the extracts, and were found to be protective about in proportion to the amount of albumen present. The coloring matter in barley grain was also ascertained to act as a screen against the deleterious rays. The living leaves were examined by the same method as the extracts, and the diastase in them was found to undergo a similar destruction under the influence of light.

The experiments lead to the conclusion that there exists in the leaf and in the various extracts examined a certain amount of zymogen, which is converted into active diastase. This conclusion is supported by an extended series of experiments upon the effect of keeping the solutions for several days at the temperature of 38° C. The violet and ultra-violet rays caused the destruction of the diastase, or at least such a change in it that it was unable to affect the hydrolosis of starch. Other conclusions which were arrived at by the author are (1) that the enzym is not located in the chlorophyll grain, but in the protoplasm of the cell; (2) that the suggestion that the red coloring matter of certain leaves is a material help to the translocation of starch in them is probably well founded, as such coloring matters screen off the rays which destroy diastase; (3) that there exists in plants a power of absorbing and utilizing the radiant energy of light without the presence of a chlorophyll apparatus. This last conclusion supplements the observations of Engelmann and Winodgradsky.

The latent life of the Uredineæ, J. ERIKSSON (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 9, pp. 475–477*).—After recounting some of the principal methods of infection that have been observed in the rusts, the author gives an account of two seemingly inexplicable infections. Plants of wheat and barley, which are especially subject to attacks of *Puccinia glumarum*, were grown in large glass tubes containing sterilized soil or in a specially constructed glass apparatus. The openings were plugged with cotton, and apparently all precautions were taken to prevent infection; yet, after about two months, spots of rust were seen upon the plants. A microscopic examination failed to show the internal presence of any parasite.

The author states that upon one occasion in examining the outer layers of cells of grains of wheat deformed by rust he found mycelium and often a sort of teleutospore. Every attempt to find the mycelium in the germ or in the recently sprouted plant failed, yet in from four to eight weeks from seeding abundant rust spots were seen upon the plants, and the mycelium was found abundant in the vicinity of the diseased areas.

As explaining the infection when neither æcidium, puccinia, nor uredo forms were observed, the author reports observations made in 1893 which he believes show a latent power of the fungus to infect its host. While examining under high power very young rust spots on wheat some peculiar corpuscles were seen in the chlorophyll cells. These special plasmic corpuscles were intermingled with the other contents of the cells, were oblong, slightly curved, and either separate or several were united together. They occur floating freely in the protoplasm or in contact with the cell wall. At other times they were branched and had penetrated the cell wall, forming a sort of mycelium with haustoria still remaining in the cells. Neither corpuscles nor intercellular mycelium were ever observed at any considerable distance from the rust spots. The author considers these corpuscles as probably a sort of primordial form from which the fungus is developed. It is believed that the fungus exists in the protoplasm of the host in a state of symbiosis, to which the name "microplasmic symbiosis" is given. Under the proper external conditions the intimate association which exists between the plasma of the host and parasite is broken up and the corpuscles and mycelium of the fungus are developed.

Fixation of atmospheric nitrogen by bacteria from the tubercles on leguminous roots, MAZÉ (*Ann. Inst. Pasteur, 11 (1897), No. 1, pp. 44–54*).—The author has investigated the ability of the bacteria from tubercles on roots of legumes to assimilate free atmospheric nitrogen when grown upon artificial culture media. The media for two series of experiments consisted of an infusion prepared by boiling uncrushed kidney beans for half an hour. To this was added 2 per cent sugar, 1 per cent chlorate of sodium, a trace of bicarbonate of soda, and the whole solidified by adding 15 per cent gelose. Plate cultures were made with this medium and other cultures were made in which the same medium was used except that the gelatin was omitted. Precaution was taken to admit a constant current of air freed from combined nitrogen. The organism was found to grow very readily on both solid and liquid media and the characteristics of the growth are given. The nitrogen was determined by the Kjeldahl method before and after the inoculation and in every case an increase was shown, the amount being given in the following table:

Fixation of nitrogen in solid and liquid media.

Series.	Initial nitrogen.	Final nitrogen.	Gain.
	Mg.	*Mg.*	*Mg.*
1, solid medium	62.1	102.9	40.8
2, solid medium	70.7	118.2	47.5
3, liquid medium	22.4	45.8	23.4

In the third series, where a liquid medium was used, at the end of the sixteenth day all the sugar had been used up, and the same is thought to have been the case with the others.

From these experiments it appears that symbiosis is not necessary for the fixation of nitrogen by the bacteria which exist in the root tubercles of many legumes. The bacteria destroy the carbohydrates furnished them by the medium in which they grow and in turn take up nitrogen. This is probably taken up and utilized by the plant through the radiant energy of the sun.

The opening lecture in a course of vegetable physiology, P. P. DEHÉRAIN (*Ann. Agron., 23 (1897), No. 5, pp. 193–216*).—This deals with arable soils and fertilizers.

A new genus of Myxomycetes, E. ROZE (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 8, pp. 417–418*).—The author reports having found in the mucous masses that are observed in the gangrene of the potato, a new slime mold to which he has given the name *Vilmorinella micrococcorum.* It is associated with *Micrococcus imperatoris, M. albidus,* and *M. delacourianus,* and is said to exist in two forms, the plasmodial or vegetative, and encysted or reproductive forms.

Effect of nitrogen on root formation (*Fühling's landw. Ztg., 46 (1897), No. 6, pp. 185, 186*).—On a number of different kinds of plants 4 side roots were left and 2 of these were placed in a solution containing all the necessary elements of plant food while the other 2 were placed in a solution containing all the necessary elements except nitrogen. In nearly every case the roots in the nitrogen solution made the better growth and differed from the other 2 roots in anatomical structure. The article ends with the conclusion that roots by themselves can form albuminoid substances without the aid of the leaves.

Inoculation experiments with Nitragin, C. FRUWIRTH (*Deut. landw. Presse, 24 (1897), No. 12, pp. 94, 95*).—The experimental crop was the kidney bean. The inoculated plats produced the most fodder while those not treated yielded a little the most grain. On one plat the crop was grown 2 years in succession without apparent gain the second year, but when 2 crops were grown in succession the same year the second crop seemed to be benefited by the inoculation caused by the first.

Inoculation experiments with Nitragin, G. LOGES and F. GLASER (*Sächs. landw. Ztschr., 44 (1896), pp. 753, 754*).—The application of Nitragin was without effect where the soil was in condition to produce a normal crop. Inoculations on light sandy soils increased the crop of beans 124 per cent and that of peas 46 per cent over untreated plats.

Directions for the application of soils for inoculation, SALFELD (*Deut. landw. Presse, 24 (1897), No. 11, p. 90*).—The soil should be taken from places where the leguminous crop has grown well, scattered evenly over the field to be inoculated, and covered immediately by harrowing or otherwise. The most germs are found in the first 3 in. of the soil.

FERMENTATION—BACTERIOLOGY.

Concerning a soluble oxidizing ferment of wine, P. CAZENEUVE (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 8, pp. 406-408*).—The presence of an oxidizing ferment in wine has been known for several years, and the author having a large quantity of wine to examine was given an opportunity for its isolation and study.

The wine was precipitated by strong alcohol and the gummy precipitate after treatment with distilled water was of an opal color or colorless. By treating again with alcohol, collecting and drying in a vacuum, a white precipitate was secured consisting of the normal gums of wine impregnated with the ferment. An aqueous solution gave reactions somewhat resembling those of laccase, and the ferment has been given the name of ôenoxydase.

The ferment withstands 0° temperature, but is almost instantly destroyed when the temperature is increased to between 70 and 75°. It changes guaiac solution to blue and oxidizes all the coloring matter in the various wines examined. The Spanish and Turkish wines seem more resistant than the French red wines. Dilute solutions of sulphuric acid destroy ôenoxydase, 0.01 to 0.08 gm. per liter being sufficient for this purpose. The action of the ferment toward various chemicals is given, and the author considers that the abundance of ôenoxydase is favored by the presence of fungi on the grapes, thus indicating that the ferment is secreted by the fungi.

The author considers the ferment the cause of a disease of wine to which he has given the name "la casse de vins."

Microörganisms and sterilizing processes in the canning industry, S. C. PRESCOTT and W. L. UNDERWOOD (*Tech. Quart., 10 (1897), No. 1, pp. 183-199, figs. 6*).

Alcoholic fermentation without yeast cells, E. BUCHNER (*Ber. deut. chem. Gesell., 30 (1897), No. 9, pp. 1110-1113*).

The influence of various substances on the alcoholic fermentation of sugar, T. BOKORNY (*Allg. Brau. u. Hopfen Ztg., 36 (1896), p. 1573; abs. in Chem. Ztg., 20 (1896), Repert., p. 277*).

Studies in wine fementation, C. FORTI (*Bol. Not. Agrar., pp. 384-413; abs. in Bot. Centr. Bl., 70 (1897), No. 1, pp. 38-41*).

Concerning the oxalic-acid fermentation by Aspergillus niger, C. WEHMER (*Centr. Bl. Bakt. u. Par., 2. Abt., 3 (1897), No. 4-5, pp. 102-104*).

The enzym in barley which dissolves cell walls, F. REINITZER (*Ztschr. physiol. Chem., 23, No. 2, pp. 175-208*).

Action of diastase on starch, A. R. LING and J. L. BAKER (*Jour. Chem. Soc. [London], 1897, May, pp. 508-522*).

Digestion of cellulose by enzyms, J. GRÜSS (*Jour. Landw., 43 (1895), p. 379*).—The author finds that the hemicelluloses undergo hydrolytic decomposition easily, although various members of the group show differences in this respect. This is of importance in connection with the solution of the cell walls by ferments during germination.—W. H. KRUG.

Bacteria, what they are and what they do, C. E. MARSHALL (*Michigan Sta. Bul. 139, pp. 59–95, figs. 26*).—This is a general treatise on the subject, including a glossary.

Bacteriology and chemistry of sauerkraut fermentation (*Arch. Hyg., 29 (1896), pp. 56–95*).

METEOROLOGY.

Notes on the climatology of the sugar beet, E. M. BOGGS (*Arizona Sta. Bul. 23, pp. 22–37*).—A table is given which shows the altitude; maximum, minimum, and mean temperatures; depth of rain and melted snow; and total depth of snow for each month of 1896 at 42 stations in Arizona and at places in other States where sugar-beet factories have recently been in operation or are in course of construction, namely, Alvarado, Chino, Salinas, and Watsonville, California; Grand Island and Norfolk, Nebraska; Eddy, New Mexico; Lehi, Utah; Staunton, Virginia; and Menomonee Falls, Wisconsin.

"Although the sugar beet is a native of the shores of the Mediterranean Sea, it has reached its highest perfection as a vegetable and its greatest importance as a commercial product in more northerly countries. This seeming paradox is due to the industry and thrift of the inhabitants of colder regions rather than to any superiority of climate."

While the beet may not require a hot climate, the data here reported clearly show that it can flourish in a hot climate where other conditions are favorable. The climate of Arizona is such that it is not necessary to provide for storage of the beets, but they can be left in the ground until wanted at the factory. The season of planting may also be so regulated that the "campaign" of the factory may be extended and the acreage which may be served by each factory largely increased. There is little or no rain between the time of maturity of the crop and the harvesting to start new growth and thus reduce the precentage of sugar and purity, and rain seldom occurs during the fall and early winter when the factories would be operated.

"While high temperature seems not to be necessary, sunshine is essential to the development of a large percentage of sugar in the beet. . . .

"Arizona leads all other sections of the United States in high percentage of sunshine. New Mexico is a good second to Arizona in this element, and its good effect is shown in the remarkably high percentage of sugar obtained from the crop worked by the factory at Eddy, New Mexico, which is the highest known. So sensitive is the sugar beet to the influence of sunshine that a few cloudy days just before the beets are harvested will materially reduce the percentage of sugar.

"In some localities in other States the crops of young beets have been destroyed or severely damaged by hard winds. In most parts of Arizona damaging winds are infrequent, or occur mainly before the season of planting.

"From all considerations it seems that climatic conditions in Arizona are favorable to the largest tonnage per acre and the highest percentage of sugar. A practical difficulty which will perhaps be experienced may be to prevent the beets from growing to excessive size, for it is not the largest beets which are most profitable."

The weather and its influence on man and the productions of the earth, J. W. SMITH (*Agr. of Massachusetts, 1896, pp. 42-51, map 1*).—Discusses this subject in a popular manner, especial attention being given to the relation of climate to crops

Agricultural weather forecasts, F. T. BRODIE (*Jour. Roy. Agl. Soc. England, 3. ser., 8 (1897), No. 2, pp. 228-233*).

Weather, O. J. KLOTZ (*Ottawa Nat., 11 (1897), No. 2, pp. 45-52*).

Recent studies on tempest and tornadoes, H. FAYE (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 21, pp. 1133, 1134*).

Effects of a hailstorm, A. FOREL (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 26, pp. 1549, 1550*).

Periodic variation of rainfall in India (*Smithsonian Misc. Coll. No. 1077; abs. in Nature, 56 (1897), No. 1440, pp. 110-115*).

The meteorology of 1894 (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 7 (1895), pp. 397-404*).—Monthly data of observations on wind, temperature, rainfall, and sunshine are reported for the year 1894 and compared with the averages of previous years.

The wind as a motive force in agriculture, F. HOUDAILLE (*Prog. Agr. et Vit., 27 (1897), No. 13, pp. 380-384*).

FERTILIZERS.

Report of analyses of commercial fertilizers for the fall of 1896, L. L. VAN SLYKE (*New York State Sta. Bul. 116, pp. 75-131*).—Analyses of 261 brands of commercial fertilizers, representing 326 samples, are reported, accompanied by explanatory notes.

"Of these different brands, 174 were complete fertilizers; of the others, 35 contained phosphoric acid and potash without nitrogen; 17 contained nitrogen and phosphoric acid without potash; 26 contained phosphoric acid alone; 5 potash salts only, and 4 nitrogen compounds alone.

"The 174 brands of complete fertilizers contained nitrogen varying in amount from 0.51 to 6.30 per cent and averaging 1.82 per cent. The average amount of nitrogen found by the station analysis exceeded the average amount guaranteed by 0.11 per cent, the average guaranteed being 1.71 per cent and the average found being 1.82 per cent. In 124 brands of complete fertilizers the amount of nitrogen found was equal to or above the amount guaranteed, the excess varying from 0.01 to 2.11 per cent and averaging 0.26 per cent. In 50 brands the nitrogen was below the guaranteed amount, the deficiency varying from 0.01 to 1.98 per cent and averaging 0.14 per cent. In 39 cases the deficiency was less than 0.25 per cent; in 8 cases less than 0.50 and over 0.25 per cent; in 1 case it was over 0.50 and below 1 per cent, and in 2 cases it was over 1 and below 2 per cent.

"The 174 brands of complete fertilizers contained available phosphoric acid varying in amount from 3.22 to 15.70 per cent and averaging 8.54 per cent. The average amount of available phosphoric acid found by the station analysis exceeded the average amount guaranteed by 0.72 per cent, the average guaranteed being 7.82 per cent and the average found being 8.54 per cent. In 120 brands of complete fertilizers the amount of available phosphoric acid found was above the amount guaranteed, the excess varying from 0.02 to 4.33 per cent and averaging 1 per cent. In 52 brands the available phosphoric acid was below the guaranteed amount, the deficiency varying from 0.01 to 2.10 per cent and averaging 0.46 per cent. In 25 of these cases the deficiency was below 0.25 per cent; in 10 cases it was above 0.25 and below 0.50 per cent; in 12 cases it was above 0.50 and below 1 per cent; in 4 cases it was above 1 and below 2 per cent; in 1 case it was above 2 and below 3 per cent.

"The complete fertilizers contained potash varying in amount from 0.36 to 14.65 per cent and averaging 4.16 per cent. The average amount of potash found by the station analysis exceeded the average amount guaranteed by 0.18 per cent, the average guaranteed being 3.98 per cent and the average found being 4.16 per cent. In 131 brands of complete fertilizers the amount of potash found was above the amount guaranteed, the excess varying from 0.02 to 2.35 per cent and averaging 0.52 per cent. In 43 brands the potash was below the guaranteed amount, the deficiency varying from 0.01 to 3.98 per cent and averaging 0.60 per cent. In 20 of these cases the deficiency was below 0.25 per cent; in 8 cases it was above 0.25 and below 0.50 per cent; in 6 cases it was above 0.50 and below 1 per cent; in 6 cases it was above 1 and below 2 per cent; in 2 cases it was above 2 and below 3 per cent, and in 1 case it was above 3 and below 4 per cent. In 9 cases the 174 brands of complete fertilizers contained the potash in the form of sulphate free from an excess of chlorids.

"The retail selling price of the complete fertilizers varied from $20 to $51 a ton, and averaged $30.25. The retail cost of the separate ingredients unmixed was $21.22, or $9.03 less than the selling price."

The present knowledge of the application of fertilizers (*Ztschr. landw. Ver. Hessen, 1897, No. 20, pp. 177-180*).—A table gives the quantities of nitrogen, potash, and phosphoric acid taken from the soil by different crops and the quantities of fertilizers required to supply them. The basis of the fertilizers is barnyard manure, and commercial fertilizers are added in such quantities as to make an economical application of plant food.

How shall we fertilize? GERLACH (*Landw. Centr. Bl. Posen, 25 (1897), No. 23, pp. 141, 142*).—A popular article on manuring with various commercial fertilizers and other fertilizing substances.

Peas as green manure, I. FORD (*Citrograph, 20 (1897), No. 19, p. 1*).—The author's experience with barley and other cereals, cowpeas, crimson and other varieties of clover, flowering or sweet peas, square-podded pea, lupines, and Prussian Blue or Canadian field peas as green manure for orchards is reported. The field peas have proved most satisfactory. Directions for their culture are given.

Dangers incurred in employing manure from cities as fertilizers for pastures, F. CLAES and B. MOENS (*Rapports Préliminaires 3e Congrès Internat. d'Agr., Bruxelles, 1895, pp. 795-797*).

Basic slag as a fertilizer, F. E. THOMPSON (*Scient. Amer. Suppl., 43 (1897), No. 1105, pp. 17659, 17660*).—A very complete summary of results of experiments with this fertilizer in the United States.

Concerning the poisonous effect of Chile saltpeter containing perchlorate (*Ztschr. landw. Ver. Hessen, 1897, No. 26, p. 233*).

Fertilizer analyses, H. B. BATTLE (*North Carolina Sta. Bul. 136, pp. 3-33*).—Analyses and valuation of a large number of fertilizers collected during the spring and fall of 1896 are given in tables, accompanied by the usual notes and explanations.

A warning in regard to compost peddlers, H. B. BATTLE (*North Carolina Sta. Bul. 137, pp. 37-41*).—Attention is called in this bulletin to a fertilizer formula which, with the ingredients required, is offered to farmers at an exorbitant price, and "the farmers of the State are urgently advised not to pay any money for fertilizing formulas, as the station is ready and willing to suggest any mixture for any crop, using any materials at hand or most convenient to be had."

The fertility of the land, I. P. ROBERTS (*New York: The MacMillan Co., 1897, pp. XVII, 415*).—This book is one of the Rural Science Series, edited by L. H. Bailey. As the subtitle states, it is "a summary sketch of the relationship of farm practice to the maintenance and increasing of the productivity of the soil." While King's book on "The Soil," in the same series, discussed the subject from the more strictly scientific standpoint, the present work approaches it from the farm side and "combines the best teachings of science with the philosophy of farm practice." The book opens with an introductory in the form of a chat with the young farmers. Then follow chapters on an inventory of the land; the evolution of the plow; tilling the land; conservation of moisture; irrigation and drainage; farm manures; manures produced by various animals; the waste of manures; the care, preservation, and application of manures; nitrogen and nitrification; the phosphoric acid and potash supply; commercial fertilizers; lime and various amendments; green manures and fallows; and rotations. An appendix gives analyses of animal manures and various other farm products.

FIELD CROPS.

Fertilizer, culture, and variety experiments on corn, R. J. REDDING (*Georgia Sta. Bul. 34, pp. 529-556*).—These experiments are in continuation of those reported in Bulletin 30 of the station (E. S. R., 7, p. 943). Meteorological data for the season are tabulated, and the influence of the abnormal conditions in reducing the yields and modifying the action of fertilizers is specially noted.

In the general fertilizer test nitrate of soda, acid phosphate, muriate of potash, and cotton-seed meal were used. The results are tabulated, but the differences in yield were so slight, owing to the unfavorable season, that no conclusions are drawn.

Plats which in 1895 had grown cotton, with amounts of fertilizers varying from 400 lbs. to 1,200 lbs. per acre, were planted to corn in 1896, each plat receiving a small amount of fertilizer. Almost no residual effect of the fertilizers was shown, the plat receiving 1,200 lbs. of fertilizer in 1895 yielding only 2 bu. per acre more than the check plat which had received no fertilizer either year.

Muriate of potash, in connection with superphosphate, cotton-seed meal, and nitrate of soda, exerted an unfavorable effect on the yield, as the plats without potash averaged 26.02 bu. per acre, those with potash 24.09 bu., and those without any fertilizer 23.63 bu. Sulphate of potash did not produce a harmful effect, but the experiment indicated that "this soil does not require the addition of potash for corn."

To test the effect of nitrate of soda applied at planting, 2 series of plants were used. On one series a complete fertilizer of acid phosphate, sulphate of potash, and cotton-seed meal was applied 6 days before planting, while on the other series part of the cotton-seed meal was omitted and an equivalent amount of nitrogen in the form of nitrate of soda added at planting time. The average yield of the plats receiving nitrate was 28.86 bu. per acre, of the plats without nitrate 28.29 bu., a difference of 0.57 bu. in favor of applying the nitrate. The added cost of the nitrate for this gain was 3 cts.

Of the 20 varieties tested in 1896, Cocke Prolific, Higgins, Henry Grady, Shaw, and Stegall led in productiveness, but of varieties tested for 5 years, Shaw Improved, Higgins, Shannon White, and Southern White gave largest yields.

To test a method frequently used in prize contests alternate plats were planted with single kernels 4 ft. apart in single rows the same distance apart, and with single kernels "spaced in each of the listing furrows 4 ft. apart, so as to stand in double rows 6 ft. apart from center to center, and the plants 4 ft. apart in each row of the double row, the successive plants alternating regularly from end to end of the double rows." The former method gives 2,704 stalks per acre and the latter

3,605. The 4 by 4 single row plats averaged 23.13 bu. per acre, and the 6 by 4 double row plats 25.56 bu. "There is strong reason to suspect that the greater yield of the double rows is due altogether to the fact that there was a larger number of stalks to the acre."

Hills of 1 stalk 3 ft. apart were compared with hills of 2 stalks 6 ft. apart, the rows being 4 ft. apart in each case. The fertilizer was distributed uniformly along the rows and it was thought that it would be less accessible to the plants at greater distances and would be more gradually appropriated through the growing season instead of being taken up in the early stages of crop growth. The differences in yield were not significant.

Tests of seed corn from different portions of the ear, while not conclusive, seemed to indicate that tip kernels were equal if not superior in productive power to the middle and butt kernels.

The bulletin concludes with popular directions for the culture of corn, a discussion of its place in rotation, and notes upon cornstalk hay.

Experiments with corn, C. C. GEORGESON, F. C. BURTIS, and D. H. OTIS (*Kansas Sta. Bul. 64, pp. 227–246*).—These include experiments on time of planting; amount of cultivation; method of cultivation; subsoiling vs. surface plowing; butt, middle, and tip kernels for seed; and varieties.

Time of planting (pp. 228, 229).—This experiment occupied 35 twentieth-acre plats, on which corn was planted at various dates, from April 20 to May 29. The planting made May 1 gave the highest average yield of good ears (30.05 bu. per acre, with a total yield of 40.64 bu.). The highest total yield (41.10 bu. per acre) was obtained from the planting made April 20. The average total yields for 1895–'96 gave similar results.

Amount of cultivation (pp. 230, 231).—Twenty-four twentieth-acre plats were cultivated from 1 to 6 times. The following table gives the average results for 3 years:

Summary of results for three years.

Cultivated.	Yield per acre.			
	1896.	1895.	1891.	Average.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*
Once	37.62	23.42	....	30.52
Twice	44.42	30.88	68.03	47.77
Three times	43.77	26.45	....	35.11
Four times	48.94	20.77	76.06	48.59
Five times	48.27	20.51	....	34.39
Six times	49.34	17.08	70.08	45.50

As will be seen, cultivation four times gave the highest yield.

Method of culture (pp. 230–233).—This experiment occupied only 12 plats. The ground was broken up in the fall and plowed to the depth of 12 to 14 in. On listed as well as surface planted plats, deep cultivation was given with a large four-shovel cultivator in the early part of the season; shallow cultivation with a spring-tooth cultivator in the latter part. The results favor listing and shallow cultivation. The author concludes that a judicious mixture of deep and shallow cultivation is preferable to continuing either one or the other through the entire season.

Subsoiling vs. surface plowing (pp. 233–237).—A series of experiments showed slight differences of yield in favor of surface plowing. Water and soil conditions made subsoiling of comparatively small importance.

Butt, middle, and tip kernels for seed (pp. 238, 239).—For seed, the butt kernels were taken from ears raised from butt kernels in 1895, and in like manner middle and tip kernels from ears raised from middle and tip kernels. Of the butts 85.9 per cent germinated, of the middle, 90.3 per cent, and of the tips 72.9 per cent. The following table summarizes the results during 5 years.

Results of planting butt, middle, and tip kernels.

Nature of seed.	Yield per acre.					
	1896.	1895.	1893.	1892.	1891.	Average.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Butt kernels	55.42	18.82	30.96	27.40	66.11	39.74
Middle kernels	53.41	16.85	28.19	31.64	62.51	38.52
Tip kernels	52.66	16.14	34.73	30.57	61.14	39.04

Varieties (pp. 240–244).—The comparison of yields between early, medium, and late varieties was in favor of late varieties. Besides this experiment, 45 varieties were tested. In an average of three or more years, Early Thompson, Hartman, Early White, Pride of Kansas, Boone County White, Early Yellow Rose, King Phillip, and Champion Yellow Dent ranked in the order named, yielding over 50 bu. per acre.

Coöperative fertilizer experiments with cotton in 1896, J. F. DUGGAR (*Alabama College Sta. Bul. 78, pp. 37–81*).—In addition to experiments on the station farm, 27 fertilizer experiments were carried on in as many localities under the same instructions. Reports were received from 21 experimenters and conclusions were drawn from 14 of the most conclusive of these reports. Results from the various experiments are tabulated.

Of cotton-seed meal, 922 lbs. proved equal in fertilizing value to 2,000 lbs. of crushed cotton seed; that is, with cotton-seed meal at $20 per ton, crushed seed as a fertilizer was worth $9.20. In the experiments 200 lbs. per acre of cotton-seed meal was used to furnish nitrogen, 240 lbs. acid phosphate to supply phosphoric acid, and 200 lbs. of kainit to furnish potash. These fertilizers were applied by twos and threes. The average increase of yields over unfertilized plats was 454 lbs. of seed cotton with the complete fertilizer, 378 lbs. with cotton-seed meal and acid phosphate, 375 lbs. with cotton-seed meal and kainit, and 322 lbs. with acid phosphate and kainit.

Fertilizer, culture, and variety experiments on cotton, R. J. REDDING (*Georgia Sta. Bul. 35, pp. 561–587*).—*Tests of varieties* (pp. 563–569).—Results of tests of 20 varieties of cotton are given in tables and notes. Strickland Improved gave the largest yield of seed cotton (2,047 lbs. per acre) and produced the largest bolls. Texas Oak produced the largest percentage of lint (36.5 per cent) and proved the most profitable. Tyler Limb Cluster and Griffin Drought Proof Prolific were the earliest varieties; *i. e.*, the largest percentages of the total yields (97 and 96 per cent, respectively) were picked before September 15.

Distance experiments (pp. 569–573).—These experiments have been in progress 6 years (E. S. R., 7, p. 954). In rows 4 ft. apart, the plants were placed at distances of 1, 2, 3, and 4 ft. The largest yield of seed cotton per acre (1,853 lbs.) was obtained when the distance in the row was 1 ft. The largest average yield of the 4 plats and the largest average yield for the 6 years was also in favor of this distance. An experiment carried on in 1893, 1895, and 1896 to determine the best proportion between the width of the rows and the distance between the plants when 7,260 plants to the acre, or 6 sq. ft. for each plant are allowed, led to the conclusion, from the average results of 3 years, that the distance between the rows should be little, if any, greater than the spaces between plants in the row.[1] The distance between rows varied from 3 to 6 ft., while the distance between plants varied inversely as the width of the rows.

Fertilizer experiments (pp. 573–587).—To 6 plats 610 lbs. acid phosphate, 47 lbs. muriate of potash, and 373 lbs. of cotton-seed meal per acre were applied, while 6 other plats received 448 lbs. of raw bone meal, 47 lbs. muriate of potash, and 119 lbs. cotton-seed meal per acre, the applications being equal in plant food. The acid-phosphate plats yielded an average of 1,158 lbs. of seed cotton per acre, while the raw-bone-meal plats yielded 1,017 lbs. This experiment shows that for cotton crops the phosphoric acid of raw bone meal is much less available and effective than the phosphoric acid of acid phosphate.

In one experiment the effects of excessive applications of muriate and sulphate of potash were studied. The basal fertilizer applied contained the 3 principal elements in such proportions as experiments had proven to be best. The amounts of muriate of potash varied from 36 to 72 lbs. per acre, and of sulphate from 60 to 120 lbs. In both cases each successive increase resulted in a successive decrease in yield. The sulphate produced a less marked effect than the muriate. The author concludes that the excessive use of potash in either form is not only a waste of that element, but an absolute detriment to the crop.

A general fertilizer test proved unsatisfactory on account of a poor

[1] At the author's request the wording of the conclusion was slightly changed from that given in the bulletin.

selection of soil. Results and conclusions of a similar experiment are given from Bulletin 31 of the station (E. S. R., 8, p. 41).

Fertilizer formulas and a rotation system are reprinted with some modifications from former bulletins (E. S. R., 6, p. 898).

Economy in using fertilizers for raising potatoes, L. L. VAN SLYKE (*New York State Sta. Bul. 112, n. ser., pp. 296–308*).—In 1895 fertilizers were applied to 22 plats at the rate of 1,000 to 2,000 lbs. per acre. Two plats were fertilized at the rate of 1,500 lbs. per acre, and one plat was left unfertilized. A second crop was grown on the same ground the next season to ascertain the benefit it would derive from the fertilizer applied the year before.

The 1,000 lbs. application increased the crop of marketable potatoes over the crop of the unfertilized plat 48.4 bu. per acre in 1895 and 39.6 bu. in 1896, while the 2,000 lbs. application increased the marketable yield over the foregoing 4.4 bu. in 1895 and 14.1 bu. in 1896.

Each 1,000 lbs. of fertilizer added to the soil an average of 36.4 lbs. nitrogen, 76.9 lbs. available phosphoric acid, and 90.6 lbs. potash. Adding these amounts to those already known to be in the soil and deducting what was removed by the crops gave 57 lbs. nitrogen, 151.1 lbs. phosphoric acid, and 153 lbs. potash left unused where 2,000 lbs. fertilizer was applied. Phosphoric acid is probably applied often in uselessly large quantities in potato growing.

The use of over 1,000 lbs. fertilizer per acre was attended with loss as compared with the use of 1,000 lbs. Tabulated statements give results in detail.

Potatoes; variety tests in 1896; potato implements, S. B. GREEN (*Minnesota Sta. Bul. 52, pp. 419–440, figs. 11*).—The results of variety tests are tabulated and a number of varieties described. Methods of treatment against blight and scab are given. The author considers the place where the seed stock was grown, the condition of the seed stock when planted, and the effects of scab and blight as important factors in comparing the results of yearly yields.

One lot of potatoes was planted May 8–9, and on July 14 15 hills of each variety were dug of the kinds that were then large enough for marketing. Among these Burpee Extra Early, Vaughan, and Ohio, Jr., yielded best. Bovee, Good News, and Polaris were the best yielding of the varieties of a marketable size July 28. Rose No. 9, a medium early variety, produced the heaviest yield, 510 bu. per acre.

Illustrated descriptions of potato cutters, planters, and sorters are given.

Seedling canes, G. S. JENMAN and J. B. HARRISON (*Rpt. Agr. Work in the Botanical Gardens of British Guiana for the years 1893, 1894, and 1895, pp. 9–127*).—The work comprises the growing and testing of seedling sugar canes, the testing of old varieties, and manurial experiments. The effects of cane diseases are discussed. Analyses of cacao and other crops are given in tables.

A large number of cane seedlings were grown and tested during the seasons of 1892, 1893, 1894, and 1895. The results are tabulated. The sugar and glucose contents and the quotient of purity of the seedlings and canes propagated from them by cuttings varied so much that no conclusion as to the influence of the parent canes on these qualities could be obtained. The variation in color, size, and sugar content was greater among seedlings from striped cane than those from self-colored canes. Canes raised from seed produced a higher percentage of fertile seed than canes of varieties long grown from cuttings. The average results of 9 crops of old varieties are given in a table. The varieties considered valuable for the colony are Bourbon, White Transparent, Mani, Po-a-ole, Red Ribbon, and Green Ribbon. An analyses of rich Bourbon canes is tabulated.

From the fertilizing experiments conducted during the years 1891–'95, it was concluded that nitrogen in the forms of sulphate of ammonia, nitrate of soda, and dried blood is the manurial constituent which mainly governs the yield. An application of 2½ to 3 cwt. of sulphate of ammonia per acre seemed most profitable. The use of nitrate of potash in the place of nitrate of soda proved unsatisfactory. Sulphate of lime gave best results when applied with nitrogen and potash. It is considered best to manure rattoon canes with nitrogen only. Manurial phosphates proved decidedly unprofitable. Potash appeared to have but little effect. The use of lime resulted in largely increasing the yields and its effect is not yet exhausted.

The history of "rind fungus" is given. The effect of the disease appears to consist in the decrease of the sugar content and a slight increase of non-sugars. It is concluded that high proportions of readily available nitrogen favor the growth of the disease. The "pineapple" disease and the cane rust are described.

Chemical analyses of the cacao tree and fruit are reported, and the process of sweating or curing the beans is discussed from a chemical point of view. The diseases of the plant and their prevention are described. Analyses and short descriptions of kola nuts, potatoes, calathea, callalu, pumpkins, ochroes, mandura, and bonavis beans, sesbania, and the calabash tree are given.

Fertilizer experiments with sugar beets at Alnarp, Sweden, 1896, S. FORSBERG (*Tidskr. Landtmän, 18 (1897), pp. 59–65*).—Fertilizer experiments with sugar beets were conducted in 3 different fields. In field A comparative experiments were made with (1) herring guano, (2) superphosphate and Chile saltpeter, and (3) superphosphate, Chile saltpeter, and kainit, the amounts applied per acre being 890 lbs. herring guano, 356 lbs. each Chile saltpeter and superphosphate, and 890 or 1,780 lbs. kainit added to the quantities of Chile saltpeter and superphosphates given. The field had been manured with 9 tons barnyard manure per acre during the fall of 1895. The average yields obtained from the different plats and the analysis of the beets grown are shown below:

Results of fertilizer experiments, Field A.

Fertilizers applied.	Yield of beets per acre.	Sugar content. By polarization of juice.	Sugar content. By alcohol method.
	Pounds.	*Per cent.*	*Per cent.*
Herring guano	41, 680	16. 25	14. 80
Chile saltpeter and superphosphate	42, 360	16. 04	13. 80
Chile saltpeter, superphosphate, and 890 lbs. kainit	40, 770	17. 17	14. 50
Blanks for preceding fertilization	41, 840	16. 81	13. 70
Chile saltpeter, superphosphate, and 1,780 lbs. kainit	40, 270	17. 46	12. 90
Blanks for preceding fertilization	39, 660	16. 08	15. 80

Results from different methods of applying Chile saltpeter.

Method of applying.	Yield of beets per acre.	Sugar content. By polarization of juice.	Sugar content. By alcohol method.
	Pounds.	*Per cent.*	*Per cent.*
One-half before sowing, one-half in July	40, 620	16. 82	14. 50
All before sowing	42, 020	16. 89	13. 80

Field B had been in clover during 1895; the size of the plats grown were 600 square meters (6,458 sq. ft.). The fertilizers applied and the results obtained are shown in the following table:

Results of fertilizer experiments, Field B.

Fertilizers applied per acre.	Yield of beets per acre.	Sugar in juice.
	Pounds.	*Per cent.*
356 lbs. Chile saltpeter, 356 lbs. superphosphate	51, 220	15. 7
356 lbs. Chile saltpeter, 356 lbs. superphosphate, and 178 lbs. potash in 37 per cent sulphate	53, 870	15. 8
13,365 lbs. peat poudrette	49, 170	16. 6
13,365 lbs. peat poudrette and 178 lbs. potash in 37 per cent sulphate	53, 090	15. 2

In Field C (sandy soil) 2 experimental plats of 500 sq. meters (5,382 sq. ft.) were set apart for fertilizing trials.

Results of fertilizer experiments, Field C.

Fertilizers applied per acre.	Yield of beets per acre.	Sugar content. By polarization of juice.	Sugar content. By alcohol method.
	Pounds.	*Per cent.*	*Per cent.*
890 lbs. herring guano, 223 lbs. potash	39, 600	15. 8	14. 5
535 lbs. Chile saltpeter, 535 lbs. superphosphate, 223 lbs. potash	42, 390	15. 8	14. 0

The total yield of sugar beets grown at the Alnarp estate (Alnarp Agricultural Institute) during 1896 was 2,950,570 kg. (6,500,000 lbs. avoir.) from 65 hectares (160 acres), an average yield per acre of 40,440 lbs. The average sugar content was: in the juice 15.70 per cent; in the beet root 14.99 per cent.—F. W. WOLL.

Progress of the several experimental farms in 1896, W. M. HAYES, T. A. HOVERSTADT, W. W. PENDERGAST, and A. BOSS (*Minnesota Sta. Bul. 50, pp. 305–341*).—The work comprised variety and seed tests and rotation experiments. The results are tabulated. Many varieties of the different grains were collected and tried, but only the best were retained for further comparison. Previous work in this line was reported in Bulletin 46 of the station (E. S. R., 8, p. 222).

Among the 13 varieties of beans grown in 1895 and 1896, "Choice Medium" produced the largest average crop, 19.6 bu. per acre.

The 11 best out of 30 varieties of barley produced yields ranging from 38.1 to 61.6 bu. per acre. French Chevalier produced the highest average yield for 4 crops—43.3 bu. per acre.

The yields of 16 best out of 81 varieties of corn are tabulated. Cosgrove and Smut Nose yielded 63 bu. per acre, the highest average for 1895 and 1896. The methods of developing corn and planting it for fodder are given.

White Wonder, Archangel, White Russian, and Black Russian gave the best 4 average yields among 18 best out of 75 varieties of oats.

A number of varieties of wheat are described and the table gives the result obtained from the 8 best out of 200 collected varieties. The average of 7 yields ranged from 19.8 to 23.7 bu. per acre. Results of the 6 crossbred varieties are given in the table. The experiments with smallest, largest, and hardest kernels for seed emphasizes the importance of selecting seed wheat of a high quality and heavy weight.

Experiments with peas, mangel-wurzels, sugar beets, ruta-bagas, turnips, and carrots are described. The cost of raising sugar beets per ton was $3.25 on weedy land and $2.09 on land free from weeds. Rotation experiments were begun in 1894, and so far potatoes—followed by mangel-wurzels, corn or field peas, wheat, and flax in the order given—best prepared the land for the succeeding crop.

Forage crops and wheat, A. A. CROZIER (*Michigan Sta. Bul. 141, pp. 115–145, figs. 4*).—Experiments were made with several forage crops and a number of domestic and foreign varieties of wheat.

A plat of alfalfa yielded nearly 5 tons of hay per acre for the season from 4 cuttings. The first cutting was made May 23 and the last September 28. The methods of growing the crop are described. Half-acre plats of dent corn, Kafir corn, and sorghum produced 15,354, 17,180, and 19,338 lbs. of green fodder, respectively. Crimson clover sown with oats and cut for green feed October 23 and November 12 yielded 5,134 lbs. on a half-acre plat, and a plat sown without a nurse crop yielded 1,870 lbs. when cut on June 24. Three varieties of Korean millet were sown at the station and this season 4 new varieties were added. Short descriptions are given of each variety. Sachaline is not considered a practical fodder crop. The flat pea (*Lathyrus silvestris*) produced

23,997 lbs. of green fodder per acre, but it was not as palatable to stock as green clover or alfalfa. Hairy vetch (*Vicia villosa*) was sown with oats but made most of its growth after the oats were cut.

Combining the results of 3 experiments with orchard grass and timothy, there were obtained from an area, clipped frequently in imitation of pasturing, 95 lbs. of hay; and from the same area left as a meadow, at a single cutting, 384 lbs. of hay. Chemical analyses of the hay obtained from both plats are given in tables.

The foreign varieties of wheat grown comprised 10 crossbred sorts from Australia, 13 varieties from Russia, and 3 from Germany. Only small quantities of seed were sown. Each variety is described and the description and history of 10 Michigan wheats are given. An experiment with wheat on muck lands is reported. White Clawson and Dawson Golden Chaff are considered best adapted to low soils.

Experimental crop notes, 1896, C. F. CURTISS (*Iowa Sta. Bul. 34, pp. 703–713*).—Tests were made of culture methods for winter wheat and alfalfa and variety tests of corn, potatoes, and oats. Three plats of Turkish Red wheat were sown at the rate of $1\frac{1}{4}$ bu. per acre on September 2, 1895. One plat was seeded with the press drill, one with the common grain drill, and the other sown broadcast.

Results from different methods of sowing.

	Grain per acre.	Straw per acre.
	Bushels.	*Pounds.*
Plat I (press drill)	41.5	3,888
Plat II (common drill)	25.9	2,569
Plat III (broadcast)	48.6	2,387

In previous tests the press drill has given the heaviest yields. It is stated that the stand for this season was too heavy for a satisfactory crop. On August 29 an acre of corn ground was sown to the same variety by drilling both ways between the rows, applying one-half of the seed at each drilling. The corn was cut and removed, but no further cultivation was given. The yield was 33.7 bu. per acre. The results of the variety test were as follows:

Variety test of corn.

Name of variety.	Yield per acre.	Shelled corn in 70 lbs. ears.
	Bushels.	*Pounds.*
Iowa Gold Mine	52.03	61.0
Early Yellow Rose	70.00	60.0
Mortgage Lifter	71.30	60.0
Capital	57.40	61.0
Golden Beauty	61.47	58.0
Yellow Dent	48.50	58.0
Nickel Plate	71.30	61.7
Golden Cap	76.50	58.0
Bloody Butcher	63.70	58.0
Champion White Pearl	63.80	56.0

The weight test of the shelled corn was made in January, when the corn was dry.

Rural New Yorker, World's Fair, and Clark Superb yielded 754.2, 493.8, and 460.9 bu. per acre, respectively, and were the most profitable varieties of potatoes. The author produces evidence that the Rural New Yorker and Rural New Yorker No. 2 are the same variety.

In the alfalfa experiment, Plat I was sown at the rate of 25 lbs. per acre and the rest at the rate of 30 lbs.

Total yield per acre of alfalfa from three cuttings.

	Upland.	Bottom.
	Tons.	*Tons.*
Plat I (broadcast)	5.30	5.52
Plat II (drilled one way)	5.18	5.52
Plat III (cross drilled)	5.25	5.12
Plat IV (press drilled)	5.08	4.22

Four varieties of oats were tested. Early Champion, Calgary Grey, and Golden yielded 73.13, 72.4, and 64.7 bu. per acre, respectively. Black Russian rusted badly.

Third annual report of field experiments carried out during 1896, D. A. GILCHRIST and P. H. FOULKES (*Jour. Univ. Extension College Reading [England], Suppl. 4, pp. 1–64*).—A report on field experiments on hay, pasture, potatoes, Swedish turnips, and mangel-wurzels, carried out in Berkshire, Dorsetshire, Hampshire, and Oxfordshire. Notes on manures and suggestions for the manuring of various crops are given.

Trials of commercial crops at the Richmond River Experiment Farm, G. M. MCKEOWN (*Agl. Gaz. N. S. Wales, 8 (1897), No. 3, pp. 167–170*).—Notes are given on the experimental growing of peanuts, arrowroot, rice, ginger, castor bean, potatoes, and various fiber crops. It was found necessary to hill potatoes to protect the tubers from the excessive heat of the summer.

Alfalfa, W. P. WHEELER (*New York State Sta. Bul. 118, pp. 142–152*).—A popular bulletin on alfalfa culture, in which the results obtained at the station are enumerated. The food value of alfalfa is compared with that of several fodder crops and the method of culture and its use as pasture, silage, and hay are described. "Alfalfa is not suited to all kinds of soils and is probably not hardy much north of the central portion of this State. It is, however, a plant of such decided value that it is well worth a trial in any locality where there is a prospect of its growing."

Growing barley for malting purposes, A. DAMSEAUX (*Rapports Préliminaires 3e Congrès Internat. d'Agr., Bruxelles, 1895, pp. 19–36*).—A popular article on barley culture and the treatment of the crop to best adapt it to malting. The price of barley during the last week of every quarter since 1880 and the amount of barley produced by European countries is given.

Beet sugar production: Possibilities for a new industry in Wisconsin, W. A. HENRY (*Wisconsin Sta. Bul. 55, pp. 40, figs. 4*).—A popular bulletin giving historical and statistical information, describing the methods of culture and the process of manufacture, and estimating the cost of producing beets, manufacturing sugar, and erecting factories. The history of the industry in Europe and America is given and its possibilities in Wisconsin are discussed. A number of cuts show exterior and interior views of factories now in operation. The experiments performed during recent years are reviewed.

Sugar beets, W. S. DEVOL (*Arizona Sta. Bul. 23, pp. 3–21, 37–44*).—A compilation made for the purpose of disseminating information respecting the sugar beet and its culture.

The effect of the division of the mother beet on seed production, F. LUBANSKI (*Deut. landw. Presse, 24 (1897), No. 35, p. 321*).—Tabulated results of experiments show that more seed can be produced by dividing the beet and growing a plant from each division than by growing a single plant from a whole beet. Beets were divided into halves and quarters and the quarters produced the most seed.

American and European crimson clover, A. SEMPOLOWSKI (*Deut. landw. Presse, 24 (1897), No. 46, p. 421*).—A report on the comparison of the two kinds of varieties at the experiment station at Sobieszyn, Poland.

Cotton industry in Turkestan, A. SHAKHNAZAROV (*Selsk. Khoz. Lyesov., 182 (1896), pp. 509–567*).

Cultivation of grass (*Farmers' Gaz., 56 (1897), No. 25, p. 373*).—A popular article on the treatment of meadows and pastures.

The grass crop, C. A. GOESSMANN (*Agr. of Massachusetts, 1896, pp. 249–263*).—A résumé and tabulated results of field experiments with grasses carried on for 7 years, beginning in 1889. The article treats of the adaptation of soil, fertilizing of grass lands, selection of seed, and restoration of meadows. A classified list of grasses is given.

Improvement of pasture land without breaking up, J. DOUGLAS (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 8 (1896), pp. 139–144*).—A popular article on the restoration and improvement of permanent pasture.

Fertilizing meadows after the first cutting, L. GRANDEAU (*Jour. Agr. Prat., 61 (1897), II, No. 22, pp. 770, 771*).—Twelve meadow plats were fertilized after the first cutting. A check plat was left unmanured. Slag or superphosphate and kainit increased the percentage of legumes in the meadow while barnyard manure had no effect on these plants. Sodium nitrate and ammonium sulphate produced the greatest increase in grasses.

On the influence of manuring on the amount and composition of the ash of various cultivated plants, P. OEHMICHEN (*Inaug. Diss. Univ. Leipsic, 1896; abs. in Chem. Ztg., 21 (1897), No. 35, Repert., p. 102*).

Thousand-headed kale vs. turnips (*Agl. Gaz. [London], 45 (1897), No. 1219, p. 446*).—A discussion of the growing of these crops and their value as forage. Thousand-headed kale is considered a better forage crop than Swedish turnips.

Lupines and lime, L. GRANDEAU (*Jour. Agr. Prat., 61 (1897), II, No. 23, pp. 806, 807*).—A résumé of experiments of growing lupines and applying lime for fertilizing purposes.

Lupines, crimson clover, and peas as green manure for oats and barley (*Ztschr. landw. Ver. Rheinpreussen, 14 (1897), No. 20, pp. 180, 181*).—Peas were the most effective, followed by crimson clover and lupines in the order named.

Raising new varieties of potatoes, A. FINDLAY (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 9 (1897), pp. 152–156*).—A popular article in which the author relates his own experience in the work of originating new varieties.

Experiments with sprouting potatoes before planting, M. WEYDEMANN (*Deut. landw. Presse, 24 (1897), No. 39, p. 357*).—The potatoes were sprouted in cold frames and then planted on ground most favorably situated. The plants were earlier in every way and made a good growth but gave only a small yield. The same results were obtained for several years. Keeping tubers in a dry airy place for a time before planting is recommended.

Total crops from early and late planted potato plats, 1895 and 1896 (*First Rpt. Woburn [England] Exptl. Fruit Farm, 1897, pp. 158, 159*).—The yields of various varieties are given in a table. White Hebron, Perkin Snowdrop, Laxton Hero, The Bruce, and Early Puritan were best in quality. "For cropping powers, combined with quality, Early Puritan was best amongst the early potatoes, and The Bruce amongst the later ones."

The breeding of wheat, W. S. HARWOOD (*Harper's Weekly, 41 (1897), No. 2118, pp. 738, 739*).—A popular article on the breeding of wheat at the Minnesota Experiment Station.

Securing grain in wet seasons, G. W. CONSTABLE (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 9 (1897), pp. 73–87, figs. 6*).—An article on the construction of the Richmond drying rack and the advantages derived from its use.

Tobacco industry in Macedonia, V. KHODASEVICH (*Selvsk. Khoz. Lyesor., 183 (1896), pp. 91–163*).

The students' cotton spinning, J. NASMITH (*Manchester: Joseph Nasmith. London: John Heywood. New York: D. Van Nostrand Co., 1897, 3. ed., pp. 622, figs. 250*).—This work describes the evolution of cotton spinning, beginning with the use of the distaff and spindle and ending with the improved machinery of the present day. The various machines used in the process are described in detail and illustrations given. A chapter of 61 pages is devoted to the culture, distribution of varieties, and statistics of cotton in the various cotton-producing countries.

HORTICULTURE.

Celery, L. F. KINNEY (*Rhode Island Sta. Bul. 44, pp. 17–19; 25–63; figs. 17*).—*Level vs. trench culture.*—The relative merits of these two methods of celery culture are considered. The main advantage of trench culture is that the roots of the plants are protected from the burning heat of the sun.

Varieties.—A study of 59 varieties was made, "the chief object being to note successive steps in the onward march of the species to a higher domesticated state." The varieties studied included the principal ones that have been grown during the past 50 years. The principal modifications that the celery plant has undergone in the last half century are localization of the fleshy growth in the center of the plant, self-blanching tendencies, and early maturity. Historical notes, descriptions, and figures are given of 10 varieties which are taken as types of the most important varietal modifications during the 50 years. Other varieties are grouped with reference to these types.

Historical sketch.—A sketch is given of celery culture from ancient times to the present. The methods in use at the present time are discussed and illustrated.

Fig culture (*U. S. Dept. Agr., Division of Pomology Bul. 5, pp. 32*).—*Edible figs, their culture and curing, G. Eisen* (pp. 5–22).—The structure of the flowers and fruit of the fig is briefly considered and the nature of the male, female, gall, and mule flowers pointed out. The edible figs cultivated in the United States belong to the species *Ficus carica*, of which there are over 400 varieties known. Other species grow wild in tropical countries. Of these the author thinks the *Ficus sycomorus* of Africa should be introduced into the Southern States. The cultivated figs are separated into the following groups according to differences in the flowers: Caprifigs, Smyrna figs, San Pedro figs, common edible figs. The first two groups are recommended only for experimental planting. The San Pedro figs are recommended only where large early figs are wanted for marketing fresh. Only a few varieties of these are grown in the United States. The common edible figs include nearly all of the varieties cultivated in America. Twenty-seven varieties of figs found useful in California are described.

The necessity for the caprification of Smyrna figs is pointed out and the process described. The climate suitable for fig culture is considered with reference to the different purposes for which the fruit is grown. Most varieties of figs require a rich, moist, loamy soil with a good percentage of lime. The trees may be propagated by budding or grafting, but are more readily grown from cuttings made from dormant wood one or two years old. Methods of making these cuttings are described. Budding, where practiced at all, is done in winter when the wood is nearly dormant. Grafting is done in the fall or winter. The method employed, a modification of the cleft graft, is described. Trees are sometimes grown from the seed of the Smyrna figs, but varieties can not be reproduced in this way. Fig trees are set either singly or two together, the latter being recommended. Directions for pruning are given. Picking, sulphuring, dipping, drying, sweating, assorting, pulling, packing, pressing, and like processes are considered in detail.

Fig culture in the Gulf States, F. S. Earle (pp. 23–32).—The fig is propagated in the South by means of cuttings usually taken from mature wood in winter. Along the coast cuttings are often made in August. The methods used are discussed. Soil, location, cultivation, and manuring are considered. Strong lime soils are best. For the "pine woods" soils manures containing considerable phosphoric acid are recommended.

The diseases of the fig in the South are briefly discussed. Root knot, caused by a very small nematode worm, is the most serious. No effective remedy is known for it. Garden and farm crops are affected very seriously by the disease, acting as a nurse crop for it, and should therefore never be grown in fig orchards. Other diseases of less importance are those caused by the tree borer, the leaf mite, leaf rust, and cercospora.

Celeste is the most popular variety grown in the South, constituting about nine-tenths of all the figs grown in Louisiana and Mississippi. The canning factories prefer it to the larger and coarser kinds. For hardiness and fruitfulness Celeste, Brunswick, and Brown Turkey are the varieties most commended. Several other varieties are characterized in the bulletin.

The uses of figs and methods of preparing and marketing them are discussed at some length.

A contribution to the physiology of the graft: Influence of stock upon scion, G. RIVIÈRE and G. BAILHACHE (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 9, pp. 477–480*).—The authors report upon the effect of stock upon scion in the case of 2 pear trees which had been grafted upon different stocks, one upon a seedling pear, the other upon a quince. The variety of the pear scions was the Triomphe de Jodoigne and the trees, which were 15 years old, had grown side by side in a garden where they were apparently subjected to conditions all of which were comparable except that of stock. Each tree bore about 300 fruits each year and for three consecutive seasons the mature fruits were collected, samples analyzed, and the averages tabulated. The color of the fruits was very different, those upon the pear stock being green and those upon the quince stock golden yellow, with a decided rose blush on the side toward the sun. Some of the other differences of the two fruits are shown in the following table:

Average of 3 years' analyses of pears grown upon different stocks.

	Kinds of stock.		Difference.
	Seedling pear.	Quince.	
	Grams.	*Grams.*	*Grams.*
Average weight of 10 fruits	280.000	406.0000	126.0000
Density of fruits	.993	.9987	.0057
Density of juice at 15°	1.046	1.0510	.0005
Acidity of juice	1.070	1.1960	.1260
Ash per liter of juice	2.166	2.4660	.3000
Reducing sugar per liter	90.066	95.4660	5.4000
Total sugar per liter	93.400	102.3330	8.9330

From the foregoing table it is seen that the average weight, density, acidity, and sugar content were in favor of the trees grafted upon the quince stock. The estimated amount of sugar in the fruit of each tree was 7 kg. for the tree upon the seedling stock and 11 kg. for the other.

These figures are in the main confirmed by observations made some years previous on winter Doyenne pear scions upon seedling pear and quince stocks.

The difference seems to be caused by a greater activity of the chlorophyll in the case of the scion upon the quince stock.

Blackberries, dewberries, and raspberries, W. PADDOCK (*New York State Sta. Bul. 111, n. ser., pp. 281–294*).—The bulletin is a report of variety tests of small fruits for 1896. The following fruits were tested: Blackberries, 27 varieties; dewberries, 4 varieties; black raspberries, 27 varieties; red raspberries, 23 varieties; purple raspberries, 7 varieties; yellow raspberries, 6 varieties. Data in regard to date of planting, yield of fruit, duration of fruiting period, percentage of early and late yield, percentage of canes winterkilled, etc., are given in tabular form. Brief notes supplement the data of the tables. The author gives the following summary:

"Ancient Briton, Stone Hardy, Early Harvest, and Agawam were the most productive blackberries on the station grounds in 1896. Snyder is valuable for its hardiness. Mersereau is promising.

"Lucretia is the only dewberry of commercial importance. Austin Improved gives promise of being a valuable acquisition.

"Of the early black raspberries Eureka and Hopkins were the most satisfactory. Mohler, Hilborn, Babcock No. 5, and Pioneer were the most productive midseason varieties, while Mills, Ohio, and Onondaga were the most productive late varieties.

"Cardinal, Columbian, and Shaffer were the most satisfactory of the purple berries.

"For early red berries Cline and Pomona are both worthy of a trial. Of the mid-season, Clark and Pride of Kent were the most productive, but they are valuable for home use or local market only. Royal Church and Cuthbert are both productive late varieties, but the former crumbles badly and Cuthbert does not stand shipping well. Olathe and Loudon are quite firm and have an attractive color which should make them valuable market varieties.

"The yellow berries are desirable for home use, and of these Caroline was the most productive of all the raspberries fruited on the station grounds."

Gooseberries, S. A. BEACH (*New York State Sta. Bul. 114, n. ser., pp. 48, pls. 11, figs. 6*).—A comparison is made of European with American varieties of gooseberries, the relative merits of each class being as follows: The European varieties are superior in varied colors and large size of fruit and in early marketable condition of the green fruit; they are also preferred at fruit-preserving establishments. The best varieties of the American class are superior in productiveness, hardiness, ease of propagation from cuttings and layers, quality of fruit, delicacy of its flavor, thinness of the fruit skins, and freedom from mildew. The European species (*Ribes grossularia*) and the 2 American species from which cultivated varieties have sprung (*R. oxyacanthoides* and *R. cynosbati*) are described in detail and the botanical features characterizing them presented in tabular form for ready comparison.

Descriptive notes are given on 193 varieties of the 489 species and varieties growing at the station. A number of these varieties are illustrated. The following summary is given:

"Downing is one of the best of the American class. Crystal very prolific, unattractive, and drops badly. Pale Red and Houghton, productive, attractive in color, objectionable on account of small size. Of the newer varieties, Champion and Red Jacket deserve especial mention.

"Industry, Crown Bob, and Lancashire Lad are among the best of the European class for marketing green. Wellington Glory has made an excellent record here. Among the newer varieties Dominion and Triumph are worthy of extended trial."

Propagation by seeds, suckers, layers, and cuttings, methods of planting and pruning, and cultivation and manuring are discussed.

The currant worm and gooseberry fruit fly are described and illustrated, and the injury caused by them noted. Spraying with Paris green or London purple while the fruit is small and afterwards with powdered hellebore is recommended for the currant worm, and picking the fruit while green is suggested as a preventive from injury by the gooseberry fruit fly. Notes are also given on the currant borer, the four-lined leaf bug, and the San José scale.

The injury done by the mildew and leaf spot diseases is noted. As a remedy for leaf spot, spraying with Bordeaux mixture once before the fruit begins to grow and 4 times after picking is suggested. The treatment recommended for mildew is spraying with potassium sulphid at intervals of 10 days until the fruit is nearly ready for market. Locations should be chosen which give good soil and air drainage and any hindrances to the free circulation of air should be provided against.

Market gardening under glass in the United States, G. E. WALSH (*Gard., 51 (1897), No. 1335, pp. 446, 447*).

Edible wild plants, J. CHAMBERLIN (*Gard. and Forest, 10 (1897), No. 486, p. 239*).

Food requirements of tomatoes, W. DYKE (*Jour. Hort., 49 (1897), No. 2538, pp. 425, 426*).—A discussion based upon chemical analyses of tomato plants.

Home propagation, J. L. BUDD (*Iowa Sta. Bul. 34, pp. 692–702*).—The bulletin treats in a popular way of the propagation of a number of fruits and ornamentals. It discusses the general principles of propagation and the methods found to be best suited to the climate and soil of Iowa. The following topics are included in the discussion: Stratified seeds, annual flower seeds, bulbs, corms, tubers, root stocks, fleshy rooted plants, perennials, small fruits, orchard fruits, sprouts and root cuttings, cuttings of young wood, stocks for budding, layering, inarching, and topworking.

The author believes that many bulbous and tuberous plants can be propagated as well in the soil and climate of Iowa as in Holland or Bermuda. With fruit trees, grafting long scions on short piece-root stocks, in order to have trees on their own roots, is strongly recommended.

Pollination of plants, L. COATS (*California Fruit Grower, 20 (1897), No. 23, p. 6*).—The d'Agen prune is reported as bearing well where mixed with other sorts. A block of 500 six-year-old d'Agen trees blossoms well but fruits very lightly. One row, however, which stands next to a row of Grand Duke plums fruits very well.

The nurseryman as an educator, F. W. CARD (*Nebraska Farmer, 21 (1897), No. 23, pp. 354, 356, 357*).—The paper also gives some suggestions in regard to nurserymen as experimenters. The author believes that as a rule nurserymen are better able to make variety tests than experiment-station workers are, and also that they can do much along lines of plant breeding.

Pruning fruit trees (*El Agr. Mexicano, 3 (1897), No. 5, pp. 151–156, figs. 3*).

Experience with Russian fruits, HARLAN (*Montana Fruit Grower, 6 (1897), No. 52, pp. 3, 4*).

Treatment of the fruiting branches of the pear, A. F. HARDY and G. BELLAIR (*Rev. Hort., 69 (1897), No. 10, pp. 225–229, figs. 6*).

Gooseberries: Best varieties and how to grow them, F. H. HALL (*New York State Sta. Bul. 114, popular ed., pp. 9, pls. 3, figs. 2*).—A popular summary of Bulletin 114 of the station (E. S. R., 9, p. 138).

Summer pruning the raspberry, J. CRAIG (*Gard. and Forest, 10 (1897), No. 483, p. 208*).—The result of an experiment with 16 varieties of raspberries is given. Part of the plants were pinched back twice and part left unpruned. The pruned plants yielded only about two-thirds as much as the unpruned ones.

Strawberry experiments at Guelph (*Canadian Hort., 20 (1897), No. 6, pp. 218–221, figs. 11*).—Tables are given showing the date of first ripe fruit, total yield of fruit, and yield before June 15 of 23 varieties of strawberries, 11 of which are described and illustrated.

Strawberries under glass, A. HARRINGTON, I. L. POWELL, and P. DUFF (*Amer. Gard., 18 (1897), No. 128, pp. 405–408, fig. 1*).

Why plant pistillate strawberries? B. DURHAM (*Strawberry Culturist, 4 (1897) No. 10, p. 4*).—A popular discussion of pollination of strawberries.

Grape culture in the Astrakhan region, V. LUPANOV (*Selsk. Khoz. Lyesov., 183 (1896), pp. 645–679*).

Grape training (*Agr. of Massachusetts, 1896, pp. 343, 344, fig. 1*).—A method of grape training is described and illustrated.

Wheeler method of grape training and girdling (*Agr. of Massachusetts, 1896, p. 346, figs. 2*).

One-arm renewal system of grape training (*Agr. of Massachusetts, 1896, pp. 336, 337, fig. 1*).

The quantity of heat required by grapevines, E. DURAND (*Vigne Amér., 21 (1897), No. 6, pp. 177–182*).

Walnut growing in southern California, H. F. GARDNER (*Pacific Rural Press, 53 (1897), No. 19, pp. 293, 294*).

The true purpose of a large public park, J. C. OLMSTED (*Gard. and Forest, 10 (1897), No. 484, pp. 212, 213*).

Art and nature in landscape gardening (*Gard. and Forest, 10 (1897), No. 482, p. 191*).

Flowers and gardens, J. N. MAY (*Amer. Florist, 12 (1897), No. 466, pp. 981, 982*).—A paper read before the Newport Horticultural Society. The methods of grouping ornamental plants are considered.

Modern bedding, T. J. WESTWOOD (*New England Florist, 3 (1897), No. 10, pp. 111–113*).—A paper read before the Boston Gardeners and Florists' Club. It points out the modern tendencies in the grouping of bedding plants and furnishes several specific examples.

Natural beauty in pleasure grounds (*Jour. Hort., 49 (1897), No. 2533, pp. 320, 321*).

A native lawn shrubbery, C. S. VALENTINE (*Amer. Gard., 18 (1897), No. 123, p. 314*).

Rockery shrubs, H. CORREVON (*Gard. Chron., 3. ser., 21 (1897), No. 539, pp. 267, 268*).

Planting climbers at the foot of large trees, E. ANDRÉ (*Rev. Hort., 69 (1897), No. 6, pp. 134, 135, fig. 1; trans. in Gard., 51 (1897), No. 1325, p. 258*).—A description is given of a device used to overcome the difficulty of growing climbers in soil exhausted by large trees.

Roses of the Victorian era (*Gard. Chron., 3. ser., 21 (1897), No. 546, pp. 377–379, fig. 1*).—An account of the progress made during the past 60 years in the improvement of roses.

Wild forms of roses, J. MEEHAN (*Cult. and Country Gent., 62 (1897), No. 2308, p. 308*).

Best five classes of roses (*Nat. Stockman and Farmer, 21 (1897), No. 4, p. 102*).

Hardy climbing roses for Canada, WEBSTER BROS. (*Canadian Hort., 20 (1897), No. 4, pp. 134–136, fig. 1*).—Notes on a number of varieties found to be hardy in Canada.

Pruning roses, R. BETTEN (*Rosen Ztg., 12 (1897), No. 3, pp. 45, 46, figs. 4*).

Results obtained in hybridization of orchids, L. GUILLOCHON (*Jour. Soc. Nat. Hort. France, 19 (1897), pp. 64–84*).—A historical account.

Deterioration of certain species of orchids, G. TRUFFANT and A. HÉBERT (*Jour. Soc. Nat. Hort. France, 19 (1897), pp. 85–98*).—A part of the data of the paper is given in *Rev. Hort., 69 (1897), No. 14, pp. 337, 338.* Orchids taken from South America to Europe do well for a year or two and then deteriorate so that new importations have to be made. Chemical analyses made of plants when imported and at different times several years later show an increase in percentage of mineral matter and a decrease in percentage of nitrogen in the deteriorated plants. The authors believe this deterioration due largely to improper nutrition under cultivation. Figures are given comparing the amount of nitrogen in French rain water and in the rain water of the native habitat of these orchids. The authors also think this deterioration due somewhat to the fact that under cultivation the flowers and flower stalks are always removed from the plant, while in nature they remain, so that the nutrient matter they contain may be reabsorbed by the plant. A table is given showing the amounts of the various constituents in the flowers and flower stalks. A fertilizer is recommended which is intended to supply proper nutriment, and in that way check deterioration.

Bouvardias for profit, M. GROWER (*Jour. Hort., 49 (1897), No. 2534, pp. 342–344, fig. 1*).—Notes on culture of Bouvardias, with an illustration.

Cassia occidentalis, E. ANDRÉ (*Rev. Hort., 69 (1897), No. 7, pp. 156, 157*).—*Cassia occidentalis* is described and notes are given on its culture and ornamental qualities.

Stopping and timing chrysanthemum blooms (*Gard. Illus., 19 (1897), No. 946, p. 102*).

The large-flowered cannas, T. Holzschuh (*Möller's deut. Gärtner Ztg., 12 (1897), No. 12, pp. 136, 137*).—About 30 sorts of cannas are described briefly and classified according to their height and also according to the use for which they are best fitted, as for pot culture, single planting, grouping, and the like.

Amelanchiers, W. J. Bean (*Gard. Chron., 3. ser., 21 (1897), No. 539, p. 265*).—Notes on the cultivated species.

Fertilizer experiments with Ericas, F. Ledien (*Gartenflora, 46 (1897), No. 11, pp. 282–293, figs. 4*).

Fertilizer experiment with Fuchsia macrostemma hybr "Mstr. Borsig." (*Gartenflora, 46 (1897), Nos. 2, pp. 37, 38; 3, pp. 70–77; 4, pp. 101, 102; 5, pp. 130–132; 6, pp. 152–154; 7, pp. 173–179*).

Chinese primulas (*Gard., 51 (1897), No. 1336, pp. 468, 469, pl. 1, fig. 1*).—Notes on culture and varieties.

Primula obconica (*Gard., 51 (1897), No. 1328, pp. 316, 317, pl. 1*).

The cultural evolution of Cyclamen latifolium, W. T. Thistelton-Dyer (*Proc. Royal Soc. [London], 61 (1897), No. 371, pp. 135–147, figs. 10; Gard. Chron., 3. ser., 21 (1897), Nos. 542, pp. 316–318; 543, pp. 330–332, figs. 6*).

Pteris tremula, W. Scott (*Amer. Gard., 18 (1897), No. 121, pp. 273, 274, figs. 2*).—Notes are given on raising this fern from spores, and transplanting it, and on its insect enemies. Illustrations are given of the fern in various stages of its growth.

Notes on lilacs, C. Marie (*Bul. Soc. Cent. Hort., 2. ser., 1 (1897), No. 1, pp. 14–18*).—Brief notes are given on the different species of Syringa. Forcing lilacs is discussed.

New large flowered cannas, K. A. Meyer (*Möller's deut. Gärtner Ztg., 12 (1897), No. 12, p. 133*).—Brief descriptions are given of about 20 new sorts the author considers the best of all the varieties recently produced.

The Claytonia of Cuba, S. Mottet (*Rev. Hort., 69 (1897), No. 7, pp. 159, 160, fig. 1*).—*Claytonia perfoliata* is described, figured, and notes are given on its value.

Gleichenias (*Gard., 51 (1897), No. 1336, pp. 472, 473, fig. 1*).—Notes on the culture and species of these ferns.

Violets (*Gard. Chron., 3. ser., 21 (1897), No. 538, p. 248, figs. 4*).—General notes on several varieties, with illustrations.

The Rockfoils (*Gard. Illus., 19 (1897), No. 943, pp. 58, 60, figs. 11*).—Notes on native habitat, culture, and ornamental qualities of about 30 species of Saxifraga. Eleven species are illustrated.

Campanulas, S. Mottet (*Rev. Hort., 69 (1897), No. 10, pp. 237–240, figs. 6*).—Illustrated descriptive notes on a number of species of Campanula.

Multiplication of ornamental aquatic plants out of doors, J. Rudolf (*Rev. Hort., 69 (1897), No. 11, pp. 258–261, fig. 1*).

The bibliography of the dahlia, C. H. Payne (*Gard. Chron., 3. ser., 21 (1897), No. 543, pp. 329, 330*).

FORESTRY.

Rate of increase on the cut-over timber lands of Minnesota, S. B. Green and H. B. Ayres (*Minnesota Sta. Bul. 49, pp. 259–304, figs. 13*).—The object of this bulletin is to present the results of a study of the conditions of the cut-over timber lands of the State and to estimate their probable natural increase and value. It is also designed to show the great losses occasioned by forest fires, in the hope that a better enforcement of the laws against forest fires will be brought about. The present work was somewhat restricted on account of the limited appropriations available for conducting the investigations, and the hope is expressed that a further appropriation to extend the scope of the work may be secured.

The forest resources of the State are given at some length, in which are shown the estimated marketable timber and its value. The condition of stump lands after logging is described, and the rate of increase by actual measurements in small and scattered trees is given. The natural restocking of unburned land is described and the rate of increase for various species of hard and soft wood is given. Numerous miscellaneous notes are given and letters from various individuals, many of whom are engaged more or less in the lumber business, are appended.

Forests in the Transcaspian region, A. RODZEVICH (*Selsk. Khoz. Lyesov., 183 (1896), pp. 201–227*).

The culture of the willow and history of its use (*Fühling's landw. Ztg., 46 (1897), No. 4, pp. 105–114*).—A popular article on willow culture in Germany. The history of the industry is given and its present condition described.

The relation of insects and birds to the present forest conditions, A. D. HOPKINS (*Proc. Amer. Forest. Assn., 11 (1897), pp. 173–176*).—Birds are considered injurious in the long run, since they do not discriminate between injurious and useful insects. The devastations to the pines of West Virginia along the line of the West Virginia Central and Pittsburg Railroad when it was being built are mentioned.

SEEDS—WEEDS.

Something about weeds, J. W. TOUMEY (*Arizona Sta. Bul. 22, pp. 32, figs. 12*).—This bulletin contains a popular discussion of the nature, classes, and injurious effects of weeds, their dissemination, both artificial and natural, and their eradication.

The author urges united action in the destruction of weeds, especially such widely distributed ones as Johnson grass and bull mallow. The need of a law in regard to concerted action and of an officer to enforce it is noted. The present law relating to cockleburs and sunflowers is given.

Descriptive notes are given on the following weeds, together with remarks on methods of destroying them: Cocklebur (*Xanthium canadensis*), sunflower (*Helianthus annuus*), ground nut (*Cæsalpinia falcaria pringlei*), horse nettle (*Solanum elæagnifolium*), miasma weed (*Verbesina encelioides*), bull mallow (*Malva borealis*), squirrel-tail grass (*Hordeum jubatum*), Bermuda grass (*Cynodon dactylon*), Russian thistle (*Salsola kali tragus*), knot grass (*Paspalum distichum*), nut grass (*Cyperus esculentus*), dock (*Rumex berlandieri*), spiny aster (*Aster spinosus*), dodder (*Cuscuta epithymum*), and Johnson grass (*Sorghum halepense*). Most of the above weeds are figured. A note is given of a few introduced weeds. Of these, the common pigweed (*Amarantus retroplexive*) is described and illustrated. A table of 50 Arizona weeds is given. The table shows the obnoxiousness, degree of distribution, method of dissemination, longevity, resistance to eradication, and whether native or introduced.

Some weeds of the mustard family, L. H. PAMMEL (*Iowa Sta. Bul. 34, pp. 656–686, pls 15*).—Brief notes are given on the economic importance of the plants of the mustard family. Detailed descriptions are given of the following weeds, together with notes on their distribution: Black mustard (*Brassica nigra*), English charlock (*Brassica sinapistrum*), white mustard (*Brassica alba*), large pepper grass (*Lepidium virginicum*), small pepper grass (*Lepidium apetalum*), false flax (*Camelina sativa*), shepherd's purse (*Capsella bursa-pastoris*), hedge mustard (*Sisymbrium officinale*), tumbling mustard (*Sisymbrium altissimum*), horse radish (*Nasturtium armoracia*), and winter cress (*Barbarea vulgaris*). A number of these are illustrated.

The mustards are disseminated chiefly with small grain seed and screenings. Some of them often escape from cultivation. The author estimates the number of seed produced by single plants of a number of these weeds. Tables are quoted from other authors showing the comparative vitality of seeds of mustards and other plants.

The following methods of extermination are recommended: For annuals, pulling up the young plants from fields, cutting the young plants on vacant lots, practicing judicious methods of rotation, plowing early in the fall, and harrowing frequently afterwards. In the case of biennials, the leafy plant of the first season must be killed by cultivation. The horse radish, the only perennial considered, is very difficult to eradicate. Plowing the land, harrowing, and picking up the roots, repeating the operation in a week, and after that keeping the young plants cut down with a hoe was found fairly successful in dry seasons.

A note is given on proposed legislation for the suppression of mustards.

Three troublesome weeds, F. L. HARVEY (*Maine Sta. Bul. 32, pp. 8, figs. 3*).—This consists of illustrated notes on the orange hawkweed (*Hieracium aurantiacum*), wild carrot (*Daucus carota*), and buffalo bur (*Solanum rostratum*), with the habits of the plants and precautions for their prevention.

Rules and apparatus for seed testing (*U. S. Dept. Agr., Office of Experiment Stations Circ. 34, pp. 9, figs. 2*).—This gives the report of the committee appointed by the Association of American Agricultural Colleges and Experiment Stations at its meeting in November, 1896, "to devise and adopt a standard form of seed-testing apparatus and method of procedure for use in all American stations," together with an illustrated description of a standard seed-germinating chamber, and blank forms for record, sampling, and report.

Dodder in alfalfa (*Agl. Jour. Cape Colony, 10 (1897), No. 11, pp. 619, 620*).—It is recommended to cut the alfalfa from the spots where the dodder occurs and cover them with 6 in. of manure, treading it down well. This kills the dodder and leaves the alfalfa to grow up through the manure. An application of a solution of 1 lb. of sulphate of iron per gallon kills the dodder without injuring the alfalfa.

DISEASES OF PLANTS.

Studies upon the smut of wheat, oats, and barley, with a résumé of treatment experiments conducted during the past three years, H. L. BOLLEY (*North Dakota Sta. Bul. 27, pp. 109–164, figs. 13*).—The author gives a report of extended observations on the life history of stinking smut of wheat (*Tilletia levis*). These investigations show that the fungus may be found in the straw in abundance, increasing in bulk as it nears the head. In general the mycelium can not be found below the second internode from the head. The region most frequented is that bearing the chlorophyll, and the mycelium is never found in the conductive tissue. It was also found that when the smut appeared on any stalk all the other stalks of that plant were affected. They may all be affected and yet show no smutty heads at maturity. The stinking smut is found to greatly decrease the growth of the straw and the formation of heads. The filaments were never found in the mature grain of wheat, and hundreds of sections failed to reveal the presence of them after the grain had begun forming starch. It is stated that in all smutted crops close observation would show that many of the grains in the partially smutted heads never reach maturity, and that the smutted straws in the field may be detected some time before the grain is matured on account of the peculiarly modified bluish-green color of the upper part of the straw. This peculiar color is thought to be probably due to the disorganization of the chlorophyll forming some abnormal solution, giving a stained appearance to the cells.

The methods of wintering the spores were investigated, and it was found that spores lying over in the ground from the past year's crop would readily infect the succeeding crop, and that smut may originate in the new crop from volunteer wheat.

The influence of date of seeding upon the amount of smut in the crop was considered to some extent, and it was found that those conditions most favorable to the wheat plant from the time of germination until it is harvested are also most favorable for the growth of the smut.

The author discusses the effect of various methods of treatment of the seed grain and tabulates results of a series of experiments which show the effect on germination and subsequent growth of plants of corrosive sublimate, formalin, hot water, copper sulphate, sulphur dioxid, and potassium sulphid when applied to wheat, oats, and barley.

A summary is given of previous field experiments conducted for the prevention of stinking smut by means of treatment with corrosive sublimate, potassium sulphid, hot water, copper sulphate, formalin, and corrosive sublimate to which formalin was added. The ratio of grain to straw and the yield per acre and percentage of smut are shown for each treatment.

Summarizing the results of treatment for wheat in 1896 the author states that under the conditions of the experiments the corrosive-sublimate treatment considerably surpassed all the other methods. When hot-water treatment was used the wheat was at evident disadvantage under the wet soil condition, the grain seeming to decay before the plants had established themselves. Copper sulphate proved efficient in preventing smut, although it somewhat reduced the yield. The author states that he can not recommend the use of potassium sulphid on account of its disagreeable nature and the irregular sprouting of wheat treated with this fungicide. Formalin as a fungicide is favorably considered as an efficient and easy means for the prevention of smut, although the experiments have not been carried on to a sufficient extent to warrant a positive declaration. Corrosive sublimate and formalin used together did not give better results than either of the substances when applied separately. The application of air-slacked lime, thoroughly mixing it with the smutted seed, is said to have some merit in preventing the disease.

The treatment in 1896 of oats and barley for smut is reported upon. Hot water, corrosive sublimate, formalin, corrosive sublimate and formalin, copper sulphate, potassium sulphid, and sulphur dioxid were tested. The use of hot water proved the most efficient treatment for oats. Potassium sulphid gave good results for barley, but was not successful when used with oats. Corrosive sublimate was not a successful treatment for oats, but a single treatment of barley proved efficient. Copper sulphate is not recommended, and sulphur dioxid as far as tested proved quite destructive to the yield and failed to prevent smut. Formalin gave very promising results with oats, and the success which was secured on some plats where corrosive sublimate and formalin were used is thought to be due to the formalin.

The effect of date of seeding on the presence of smut in oats is briefly reported upon. Notes are given on the amount of moisture absorbed by wheat in course of treatment, apparatus for dipping purposes, the swelling of grain after treatment, and the cost of treatment. Recommendations are made for the treatment of wheat, oats, and barley for the prevention of smut. Copper sulphate, corrosive sublimate, hot water, and formalin are recommended for wheat, and hot water, formalin, and potassium sulphid for oats and barley.

Broom-corn smut, G. P. CLINTON (*Illinois Sta. Bul. 47, pp. 373–412, pls. 5*).—The author states that there are 3 smuts, *Ustilago reiliana*, *U. cruenta*, and *U. sorghi*, which are more or less abundant on broom corn. In the present paper the species referred to is *Ustilago sorghi*. The author claims that on account of the germination of the spores and according to the rules of nomenclature adopted the name should be *Cintractia sorghi vulgaris*. The nature of the injury and amount of loss occasioned is stated and the life history of the fungus quite extensively given.

Experiments were conducted to ascertain the effect of hot-water treatment of the seed, and as has been shown in experiments with other plants, the treatment in many cases increased the total germination of the seed. The germination of the spores, however, was to a great degree destroyed by soaking the seed for about 15 minutes in water heated to 135°. Spores, in unbroken masses, can withstand immersion in water of considerable higher temperature, the degree depending upon the thickness or impermeability of the membrane.

The effect of cold on the germination of spores was also investigated, and it was found that placing them on ice for 15 minutes or 1 hour or in ice water for 4 hours had no appreciable effect upon their germination.

During the years 1894, 1895, and 1896 field experiments were conducted to determine the relation of smut in the land to the amount of smut in the crop, and it was ascertained that previous crops of diseased broom corn bore no relation to the infection of a subsequent crop grown upon the same soil, and that the hot-water treatment greatly lessened the amount of smut panicles.

The experiments seemed to indicate that the fungus gains entrance into the host immediately after germination, and smut spores placed upon the young plant as it emerged from the ground gave no increase in the amount of smut.

The relation of host and parasite is considered at some length and an historical review of the bibliography and nomenclature of the fungus is given. A summary of results and complete directions for the prevention of broom-corn smut by the hot-water treatment completes the bulletin.

Notes on celery diseases, L. F. KINNEY (*Rhode Island Sta. Bul. 44, pp. 19–25, figs. 3*).—Notes are given on the occurrence of black heart, blights, and blast of celery. These diseases are apparently not peculiar to any particular variety, and there is no indication that the spores are introduced with the seed when planted. The somewhat general belief that excessive drought causes these diseases was not borne out in the experiments, since black heart and blight prevailed in the irrigated sections of the fields. The general belief appears well founded that considerable clay in the subsoil is an important factor in celery culture, which is probably due to its preventing the drying out of the soil. Bordeaux mixture seemed to check the disease upon the leaves, but later in the season, when the weather became cool and the mixture washed from the leaves, little if any difference could be detected in the appearance of the rows which had been treated and those which had not. The previous growth of celery on the land seemed to bear no relation to the amount of black heart and blight on the plants experimented with, and there were no indications that the diseases were particularly contagious.

There appears to be some relation between the celery diseases and hot weather, since they always appeared in the most violent form either during or subsequent to a period of high temperature. It is probable that the celery plants can perform their functions in an atmosphere with high temperature, provided the soil about their roots is moist and cool. In investigating this point the effect of trenching and mulching was considered to some extent, and it was found that while a lack of proper protection of the roots was not the sole cause of celery disease, yet this seemed to be the principal cause in the cases where level culture was practiced.

The familiar occurrence of hollow-stalked plants is mentioned, and various varieties were investigated. While all varieties have produced them at times, with some varieties they appear more commonly than with others. The production of hollow stalks is thought to be an hereditary trait, and conditions of soil may also have something to do with their occurrence.

The treatment of plant diseases in 1896, F. D. CHESTER (*Delaware Sta. Bul. 34, pp. 22, figs. 4*).—During the year experiments were conducted for the treatment of potato rot, apple scab, potato scab, and black rot of the sweet potato.

In continuation of the experiments reported in Bulletin 29 of the station (E. S. R., 7, p. 785) the author sprayed Hale Early and Early Rivers peach trees for the prevention of rot, 97 trees of Hale Early and 32 of Early Rivers being treated. The experiments show that spraying will increase the amount of sound fruit from threefold to fourfold, and that while the previous year spraying after the fruit reached the size of large peas did not diminish the amount of rot, the contrary effect was observed this season. Spraying trees 10 days or 2 weeks after the beginning of coloring did not effect the diminution of the rot.

The recommendations of the author for the treatment of peach orchards are (1) to spray heavily with Bordeaux mixture just before the blossoms open; (2) when the fruit has set give second spraying, adding 3 oz. of Paris green to a barrel of the Bordeaux mixture; and (3) when the fruit begins to color spray with copper acetate solution (8 oz. to a barrel of water), and repeat in from 1 to 2 weeks if conditions are favorable to the development of the rot.

The principal sources of infection are pointed out, and especial attention is called to the necessity of removing and destroying decayed fruits. Besides spreading the peach and plum rot, if the fruit is allowed to remain for a long time upon the tree the fungus will make its way into the twigs and kill the wood at the point of attachment.

Experiments for the prevention of apple scab were conducted with Strawberry and Winesap apples, in continuation of those reported in Bulletin 29 of the station, and it is shown that 4 applications of Bordeaux mixture did not decrease the amount of scab sufficiently to warrant the extra expense, and that 3 applications increased the yield of first-class fruit more than 5 times that of trees not sprayed.

The treatment of seed potatoes with sulphur as a preventive of scab was tested on 8 plats of potatoes. The land was presumably free from scab, there being no record of potatoes ever having been grown on the land. Before planting, the cut tubers were dipped in water, immediately drained, and the pieces, while still wet, rolled in sulphur. The results obtained seemed to warrant the statement that rolling the seed potatoes in sulphur previous to planting will diminish the amount of scab in the resulting crop when grown upon land apparently free from scab.

The use of sulphur as a preventive for black rot of sweet potatoes was tested. As each plant was set a tablespoonful of sulphur was placed around the roots. Five rows across a field were treated in this way, and 5 with a considerable space between them were left as checks. The results of the experiments indicated that sulphur applied in this way had a decided effect in diminishing the black rot. The loss on the check rows was so slight, however, that it scarcely paid for the trouble and expense of treatment.

Treatment of leaf spot in plum and cherry orchards in 1896, S. A. BEACH (*New York State Sta. Bul. 117, pp. 133-141*).—This work, which is in continuation of that given in Bulletin 98 of the station (E. S. R., 8, p. 139), was conducted to investigate the means for the control of the leaf spot on plums and cherries. Since the previous work showed that 3 applications of Bordeaux mixture were sufficient to control the disease, experiments this year were conducted to ascertain the proper time for their application. With plums it appears that if but 2 or 3 treatments are to be made the first should be given during the last week of May, or about 10 days after the petals fall; the second about 3 weeks later, and the third about 3 or 4 weeks after the second application. When the disease is no more prevalent on plums than it was during the summer of 1896, 2 sprayings, applied as described above, will practically prevent all injury.

The experiments with cherries were conducted to test the efficiency of eau celeste, soap mixture, and Bordeaux mixture. In general in 1895 the foliage of the cherry trees was injured by applications of eau celeste mixture, but in 1 group of Reine Hortense cherries the Bordeaux mixture caused the greater injury. In the spraying experiments conducted in 1896 no injury was apparent on the leaves as a result of the sprayings, even though the trees were thoroughly drenched with Bordeaux mixture. When the Bordeaux mixture is applied as late as May 25, it is very liable to show on the fruit and injure its appearance.

Notes on some Ustilagineæ parasitic on grain, E. VON JANCZEWSKI (*Ztschr. Pflanzenkrank., 7 (1897), No. 1, pp. 1-4*).

Culture experiments with some Hymenomycetes, C. WEHMER (*Centr. Bl. Bakt. u. Par., 2. Abt., 3 (1897), No. 6, pp. 151-153*).

Continued observations concerning the specialization of the black rust, J. ERIKSSON (*K. landt. Akad. Handl. Tidskr., 36 (1897), pp. 114-117*).

The present status of the grain-rust problem, J. ERIKSSON (*K. landt. Akad. Handl. Tidskr., 36 (1897), pp. 99-110*).

On the occurrence of Bacillus pseudanthracis in flesh meal, R. HARTLEB and A. STUTZER (*Centr. Bl. Bakt. u. Par., 2. Abt., 3 (1897), Nos. 4-5, pp. 81-86; 6, pp. 129-134; 7-8, pp. 179-183*).

Concerning the attack on grape shoots by Botrytis cinerea, U. BRIZI (*Centr. Bl. Bakt. u. Par., 2. Abt., 3 (1897), No. 6, pp. 141-146*).

French stocks resistant to the black rot, J. DUCOS (*Prog. Agr. et Vit., 27 (1897), No. 16, pp. 491-493*).—The author maintains that some stocks are more resistant to black rot than others.

Black rot and resistant varieties of vines, F. COUDERC-MIMEREL (*Prog. Agr. et Vit., 27 (1897), No. 14, pp. 419, 420*).—The author thinks that fungicides are not wholly efficient in preventing black rot and that attention should be turned to resistant varieties.

Bacterial gummosis of grapes, PRILLIEUX and DELACROIX (*Ann. Inst. Nat. Agr., 16 (1891-'92), No. 14, pp. 31-59, pl. 1*).

Pseudocommis vitis, E. ROZE (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 13, pp. 704, 705*).

Notes on diseases of Lilium harisii, L. H. BAILEY (*Amer. Florist, 12 (1897), No. 464, p. 942*).

Root knot of pines, V. H. HARRIS (*Florida Farmer and Fruit Grower, 9 (1897), No. 17, p. 262*).—The author states that the application of fertilizers especially rich in potash and phosphoric acid arrests the disease, and, as one year's trial indicates, is very beneficial.

Parasitic diseases of the mulberry tree, A. N. BERLESE (*Riv. pat. Veg., 5 (1896), Nos. 5-8, pp. 196-210*).

Disease of the branches of mulberries from Turkey in Europe, PRILLIEUX and DELACROIX (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 21, pp. 1168-1170*).

The asparagus rust, C. SAJO (*Oesterr. landw. Wochenbl., 1896, p. 410; abs. in Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 7-8, p. 197*).—Descriptive notes are given of *Puccinia asparagi*.

New observations concerning the nature and appearance of the crown rust (Puccinia coronata Corda), J. ERIKSSON (*K. landt. Akad. Handl. Tidskr., 36 (1897), pp. 118-135*).

Studies of Puccinia arrhenatheri Kleb, J. ERIKSSON (*K. landt. Akad. Handl. Tidskr., 35 (1896), pp. 356-369, pls. 3*).

Notes on Puccinia digraphidis, H. T. SOPPIT (*Ztschr. Pflanzenkrank., 7 (1897), No. 1, pp. 8-10*).

Parasitic fungi in Cherson, L. REUTER (*Ztschr. Pflanzenkrank., 7 (1897), No 1, pp. 20, 21*).—Notes are given on species of economic importance.

Treatment of Nectria on pears (*Rev. Mycol., 19 (1897), No. 74, p. 73*).—The thorough use of Bordeaux mixture is said to prevent attacks of *Nectria ditissima* on pears.

Water as a means for combating plant and animal injuries (*Ztschr. Pflanzenkrank., 7 (1897), No. 1, pp. 47-50*).

Spraying for plum and cherry leaf spot, F. H. HALL (*New York State Sta. Bul. 117, popular ed., p. 4*).—This is a popular edition of Bulletin 117 of the station (E. S. R., 9, p. 148) treating of the prevention of the plum and cherry leaf spot by applications of fungicides, of the fungicides to use, and how often they should be applied.

ENTOMOLOGY.

Insects injurious in 1896, O. LUGGER (*Minnesota Sta. Bul. 48, pp. 270, figs. 187, pls. 16*).—This bulletin is divided into two portions, the first of which is devoted to a popular discussion of the various insects injurious to vegetation during 1896, while the second forms a popular treatise on the parasites of man and domestic animals.

In the first part some 17 insects that have been more or less injurious in the past or which have recently become so are discussed. The chinch bug is stated to have been found in comparatively small numbers during 1896 in all portions of the State, with the exception of some counties along the Minnesota and Mississippi rivers, which started with a fairly large number of these pests.

During 1895 diseased spores were scattered in many places, and it appeared from the absence of the bugs in these places at the beginning of the succeeding year that good results had been obtained. At any rate the bugs, although they had been in very large numbers before, had disappeared, and in consequence of this fact fewer requests for boxes of spores were received. The author seems to deprecate this latter fact, since it seems to show that the farmers seldom think of applying for remedies until the insects have become very injurious. During 1896 the climatic conditions were such that the chinch-bug disease worked with entire satisfaction wherever it was conscientiously tried, and some 1,233 farmers were supplied with boxes of spores. But in spite of the apparent success the author questions whether the fungus always kills the bug, and states that the more he and his assistant work with the fungus the less certain they feel that it is a remedy always to be relied upon.

During the summer and early autumn numerous complaints of insect depredation were received from various portions of the State. Upon investigation, the depredations were found to be caused by the frit fly (*Oscinis soror*), which was damaging wheat fields. The wheat stem maggot (*Meromyza americana*) was found to have appeared again in destructive numbers, which threaten the crops of small grain in the future. Experiments to determine whether this insect has many parasites showed that the latter are not sufficiently numerous to promise much future assistance, and the only remedy that farmers can rely upon seems to be systematic rotation of crops. The Hessian fly (*Cecidomyia destructor*) caused considerable losses in Minnesota for the first time, but parasites of the insect were so numerous and active in some places that most of the flies have been destroyed. Among the parasites *Merisus destructor*, *Eupelmus allynii*, and *Polygnotus hiemalis* are mentioned. The army worm (*Leucania unipuncta*) was also very injurious, and during July and August many gloomy accounts of it and the ruin it threatened appeared in the newspapers. All portions of the State were infested, even the unsettled region of the extreme north. Near Northfield the worms covered an area of from 4 to 5 square miles, and occurred in scattered patches over the country as far as 20 miles in all directions. In some cases ditches were dug about uninfected fields, with the usual good results. The worms were found to be attacked by several parasites, some 60 per cent of those examined being found to contain the maggot of tachinid flies or parasitic wasps. Among these parasites were found the tachinid, *Exorista leucaniæ*, and the hymenoptera, *Apanteles congregatus* and *Ophion purgatum*. But the best friends of the farmer, the author thinks, are such animals as the shrew, skunk, weasel, and gopher, which devour the worms in large numbers.

The erratic army worm (*Noctua fennica*) was also numerous, and in some cases its presence was painfully evident, since no living green thing was left untouched. Even the bark of young poplars, willows, cherries, and sumacs was eaten. An examination of the worms resulted in finding but few parasites; in fact, only one species was found, viz, *Meteorus vulgaris*. Two species of white grubs (*Lachnosterna tristis* and *L. rugosa*) were very numerous and did considerable damage. The popular impression that these grubs develop in stable manure, the author points out, is erroneous and is due to the fact that the larvæ of the shiny beetle (*Chalepus trachypygus*), which is found in heaps of old manure, closely resembles the white grub. The best remedies against this pest, the author thinks, are the use of decoy lights and the protection of all insectivorous birds, such as the sea swallow, and the small mammals just mentioned as destructive to the army worm.

The other insects discussed are the common hairy rose beetle (*Euphoria inda*), the potato beetle (*Doryphora decemlineata*), the domestic cricket (*Grillus domesticus*), the box-elder leaf roller (*Cacœcia semiferana*), the grapevine leaf hoppers (*Typhlocyba vulneata* and *T. comes*), the celery tree hopper (*Cicadula 4-lineata*), the lilac borer (*Sesia syringæ*), the plum gouger (*Coccotorus prunicida*), and the plum curculio (*Conotrachelus nenuphar*). The cricket was reported to have prevented the renting of houses which they had invaded. The box-elder leaf roller did considerable damage in 1895 and threatened to do so in 1896, but the rainy weather of the spring months proved disadvantageous to their increase. Experiments were made with Paris green and Raupenleim, which demonstrated that these substances may be recommended as remedies.

A number of experiments were also made with remedies against the grapevine leaf hoppers. A spray of kerosene and water seems to have had no immediate effect, nor did a solution of tobacco and soap. A tobacco extract known as Scab Cura sheep dip applied as a spray proved fairly successful when used in the strength of 1 to 10.

In the second part the author discusses the subject of parasitism, using the term in its widest sense, and then proceeds to consider the parasites first as external and second as internal. Several insects are included which, like *Aradus cinnamomeus*, the water boatman (*Notonecta undulata*), the electric light bug (*Benacus griseus*), *Læmophlœus fasciatus*, *Myrmica scabrinodis*, and the cow killer (*Sphæropthalma similima*) can only occasionally be considered as parasites. The different genera and the number of species and varieties considered are: Sarcoptes (14), Psoroptes (4), Symbiotes (5), Trombidium (2), Dermanyssus (3), Gamasus (1), Tyroglyphus (2), Chalepus (1), Boophilus (1), Dermacentor (1), Pediculus (2), Phthirius (2), Hæmatopinus (8), Trichodectes (8), Goniodes (6), Lipeurus (9), Menopon (3), Docophorus (2), Ornithobius (1), Trinotum (3), Pulex (3), Sarcopsylla (2), Melophagus (1), Hippobosca (1), Musca (1), Sarcophaga (2), Campsomyia (1), Stomoxys (1), Glossina (1), Calliphora (1), Hæmatobia (1), Tabanus (3), Chrysops (1), Oscinis (2), Simulium (5), Culex (2), Acanthia (2), Aradus (1), Notonecta (1), Benacus (1), Lopidea (1), Læmophlœus (1), Myrmica (1), Sphæropthalma (1), Linguatula (1), Dermatobia (1), Gastrophilus (5), Œstrus (1), Hypoderma (2), Cuterebra (4), and Chionea (1).

A large number of recipes for dips, ointments, and other remedial measures are given, and the life histories of the different forms are brought out sufficiently to give a fair idea of the best means of treatment. For the sake of completeness a few foreign insects, like the tsetse fly (*Glossina morsitans*), are included. A new species (*Cuterebra sterilator*) is described and figured, and the first published figure of a species of Ceratopogon, known as "No-see-um" or "Punkie," is given. The former insect closely resembles *C. emasculator*, and was found leaving the burrow of a striped gopher. From this latter fact the author supposes it to be the adult of the emasculating bots of this small mammal.

The sheep gadfly (*Œstrus ovis*) is treated somewhat at length. Persian insect powder blown forcibly into the nostrils or used as an extract in alcohol is recommended as a remedy, as also the usual methods of removing with a feather moistened with oil or carbolic acid or creosote.

The mosquito is also treated at length and original figures given. The author kept a sort of census of the number raised in two barrels of rainwater. On July 6 the water in one barrel was filtered and found to contain 35 grams of mosquitoes, which by actual count was found to be the weight of 7,595 larvæ and pupæ. Besides these there were 32 egg masses which would produce about 9,664 mosquitoes, making a total of 17,259. The other barrel was examined July 22, and by the same process 19,110 mosquitoes counted.

It is repeatedly pointed out that parasites may be injurious aside from their mere parasitic habits, by their transmitting the germs of disease, as in the case of flies after crawling over contaminated bodies; or, as in the case of some other bugs and the mosquitoes, from their having previously bitten diseased animals. Finally, there is a brief account of the snow fly (*Chionea valga*)—figures of which are given. The author states that about Christmas this insect was observed in large numbers upon newly fallen snow. Generally, the insects were seen in the early morning, and it was observed that the sexes copulate in spite of the cold, and that the female crawls down into a crevice in the snow and deposits her eggs.

Studies of the life histories of grass-feeding Jassidæ, H. OSBORN and E. D. BALL (*Iowa Sta. Bul. 34, pp. 612–655, pls. 7*).—The observations made upon these hemipterous hoppers during the past 5 years are briefly summarized by the statement that, although seldom noticed, the loss from these insects must be truly enormous, and that by the proper use of the tar-pan or "hopper-dozer" the numbers of the insects may be materially reduced.

The aim of the authors in the present studies was (1) to determine the life histories of as many as possible of the grass-feeding species, (2) to learn their range of food plants, especially when in the larval condition, (3) to collect all grass-feeding species with a view to their identification and to the formation of a basis for future life-history studies. Summarizing the results of his work he says:

"Of a number of species we are able to present sufficient details of life history to warrant final conclusions, while of others the record is yet too fragmentary to be more than a starting point for future work. Some of the results which seem to be general in nature may be mentioned here.

"The species of Jassidæ have as a rule a decided limitation as to food plants, usually holding closely to one species of plant, almost invariably limited to one plant for breeding, but feeding more indiscriminately in maturer stages.

"So far as known all the species deposit eggs upon the stems under the leaf sheaths or in the leaves of the plants used as food.

"There is a wide difference in life histories, some having one brood, the majority of the grass-feeding species two, and still others three in a season, and the successive stages occurring at widely different times.

"Except in the case of adult hibernation the ordinary life of a brood of adults does not exceed two months, and for the individuals of a brood rarely over one. The males appear a week or ten days before the females and disappear as much earlier. In general, one brood of adults will have disappeared before the larvæ of the next have matured, so that individuals collected at any time may be referred with assurance to a particular brood.

"It follows also that eggs for each brood are deposited within a limited time and that a period may be defined during which all eggs of a given brood for a given species will have been deposited and during which measures for their destruction may be applied.

"Observations were made to ascertain whether simply cutting the grass and leaving it in the field would prevent hatching, and in no case were eggs observed to hatch from the stems cut green. Part of the stems from a plant in which eggs were fully developed were cut and left to dry. The second day after the eggs hatched in the uncut stems, but no larvæ issued from those that were cut, and on examination the eggs were found to be crushed and distorted from the shrinking of the plant tissues and by the curling of the edges of the sheaths in drying. Even if hatched they would have been unable to escape from the rigid incurved edge."

The method of study was largely that of rearing in brooding cages made of glass globes or netted frames over grass in large plats together with continuous field study. Many thousands of individuals in all stages were examined. Some 60 species were noted as grass feeders.

Some of these, like *Diedrocephala coccinea*, *Xerophlœa viridis*, *Gypona octo-lineata*, *Parabalocratus viridis*, *Platymetopius cinerous*, *Deltocephalus sayi*, *D. configuratus*, *D. albidus*, etc., are noted as double-brooded. Further, some are shown to exhibit the phenomena of seasonal dimorphism, and the *Gypona flavilineata* of Fitch is shown to be nothing more than the first brood form of *G. octolineata*.

Several of the species, as for example *Deltocephalus oculatus* and *Athysanus obtulus* and *A. bicolor* are partial to *Andropogon scoparius*.

Most of the species are described and the adults and larvæ together with many of their structural details figured in the plates.

Other species noted are *Diedrocephala mollipes*, *D. noræboracensis*, the eight-lined gypona (*Gypona octolineata*), *Euacanthus acuminatus*, shovel nose leaf hopper (*Dorycephalus platyrhynchus*), spoon bill leaf hopper (*Hecalus lineatus*), *Deltocephalus debilis*, *D. inimicus*, *D. melsheimeri*, *D. inflatus*, *D. reflexus*, *D. pectinatus*, *D. abbreviatus*, *D. compactus*, *D. signatifrons*, *D. weedi*, *D. sylvestris*, *D. ouclatus*, *D. minimus*, *Athysanus curtisii*, *A. bicolor*, *A. obtutus*.

The San José scale in Illinois, S. A. FORBES (*Illinois Sta. Bul. 48, pp. 413–428, figs. 2*).—This bulletin is based upon a paper read by the author before the State Horticultural Society in December, 1896 The author's own brief experience with this pest bears out fully statements made elsewhere.[1] "For example," he says, "a single orchard in this State has already lost 1,000 trees, killed by this scale, notwithstanding very considerable efforts on his part to dislodge it, and his present orchard property of some 700 trees is all thoroughly infested. From this place, near Sparta, in Randolph County, the pest has overflowed into surrounding orchards and has possibly been distributed elsewhere, no one knows how far nor in what amount." Within the 7 months preceding the date of writing 15 widely separated localities were found within the State thoroughly attacked by the insect.

After briefly describing the insect and its life history, he notes the numerous food plants of the insect, touches upon the subject of the origin of the scale in the United States, and upon the precautionary measures taken in Illinois, and then goes on to consider its origin in that State and the results of his investigations.

The fact that attempts to discover it in the State in 1894 by merely collecting scale insects ended in failure is cited as proof that little can be expected from general or indiscriminate searching without clews as to probable places and times of introduction. A letter from Lewisburg, Pennsylvania, stated that specimens of the pest had been sent there from Quincy, Illinois. From this clew the author was finally able to trace the introduction of the pest to infested nurseries in New Jersey, and from lists of Illinois purchasers obtained from New Jersey nurserymen it was learned that some 119 places and 146 persons had been supplied with stock.

Circular letters of warning and advice were sent out and a system of visitation begun that subjected all of the suspected localities to thorough inspection. Ninety-eight localities and 113 orchards and nurseries had been visited at the date of writing and 2 additional places of infestation found that increased the number reported to 17.

In the various orchards visited, from one to several trees were found infested, and at Richview, Washington County, a few scales were found even upon Kiefer pears which, as a variety, have been supposed to be entirely free from attack. No cases were found where the pest had been introduced by trade within the State.

The author believes it best to limit recommendations of insecticides to a whale-oil soap solution in which 2 lbs., of the soap are employed to each gallon of hot water, and quotes the recommendations given in the bulletin of the Division of Entomology of this Department already mentioned.

The San José scale in North Carolina, G. McCarthy (*North Carolina Sta. Bul. 138, pp. 45-55, figs. 1*).—This is a popular bulletin on the San José scale (*Aspidiotus perniciosus*), giving a brief description of the insect, its life history, modes of dissemination, and reporting 7

[1] U. S. Dept. Agr., Div. of Entomology Bul. 3, n. ser. (E. S. R., 8, p. 500).

experiments made with whale-oil soap, a rosin-whale-oil mixture, and the "Rochester Sanitary Fluid" as remedies. The well-known insect enemies of the scale are mentioned.

The experiments showed that the whale-oil soap applied hot in the form of a spray killed from 95 to 98 per cent of the scales, while applied with a scrubbing brush it killed only about 70 to 80 per cent. The rosin wash used as a spray killed about 90 per cent. A mixture of whale-oil soap and the "Rochester Sanitary Fluid" (1 lb. whale-oil soap, ½ gal. of the fluid, and 7 gals. of water) applied hot destroyed only 50 to 60 per cent. The sanitary fluid diluted with one volume of water did somewhat better work, but it is too expensive a remedy to be recommended for general use. Diluted with five volumes of water and applied in the form of a spray and with a scrubbing brush it gave almost negative results.

The use of hydrocyanic-acid gas is recommended where it is practicable. Infected nursery stock should be burned, for when once badly attacked it rarely makes vigorous trees.

Formulas for whale-oil soap, the winter rosin wash, and hydrocyanic-acid gas, with the customary directions, are given. Then follows the text of the State law (Senate Bill 243), entitled "An act to prevent the introduction and dissemination of dangerous insect, fungus, and weed pests of crops" and of a paper regarding the same read before the Assembly. This mentions briefly the cotton boll weevil, the gypsy moth, the tobacco leaf miner, the San José scale, and peach yellows. Of the $400,000,000 damage done by insects and fungi in the United States, $2,000,000 is thought to be North Carolina's share.

The woolly aphis of the apple, J. M. STEDMAN (*Missouri Sta. Bul. 35, pp. 61, figs. 6*).—A popular account is here given of this insect (*Schizoneura lanigera*), its life history, habits, and injuries to orchards in Missouri. *Aphelinus mali*, *Pipiza radicum*, *Scymnus cervicalis*, and *Chrysopa* sp. are mentioned as natural enemies, and experiments with tobacco dust, carbon bisulphid, and kerosene are recorded. Cages for laboratory studies of the root form of this insect are described and figured.

In the experiments with carbon bisulphid 20 trees were treated on June 29 by injecting from 1 to 3 oz. of the liquid close to the crown of the tree. As a result, every tree was found within a month to be either wholly or partly dead. Every portion of the tree with which the bisulphid came in contact was killed. Later, August 25, 30 badly infested apple trees were treated with the same substance by injecting from 1 to 3 oz. from 1 to 2 ft. away from the crown. Five trees were treated with 1 oz. at the distance of 1 ft. from the tree on 3 sides, 5 trees received the same treatment except that the distance from the tree was 2 ft., 5 trees received 2 injections on 2 sides at the distance of 1 ft. from the trunk, and 5 other trees the same treatment at a distance of 2 ft. In another lot of 5 trees, only 1 injection of 1 oz. was made at the distance of 1 ft. In still another 5, the same amount of fluid and number of injections were made at the distance of 2 ft. As a result it was found later that where the injections had been made on one side of the tree only, the insects upon the opposite side were not killed.

The author considers tobacco dust superior to any other insecticide. As a fertilizer it is worth all it costs and as an insecticide against the woolly aphis it is worth much more. In nurseries it may be placed in small trenches dug along next to the rows of grafts, buds, or small trees, and covered over. The application should be repeated each spring. In experiments with this remedy, in the case of large trees, the dirt was removed from around the crown of each tree for a distance of about 2 ft. and to a depth of about 4 in. In the excavation thus made the tobacco dust was evenly distributed at the rate of 3 to 5 lbs. per tree and then covered over. This was in June. In August the same trees were given another supply of the dust and in October they were examined. Only 2 out of 15 trees treated were found to be still infested with the aphis. None of the trees died or were in any way injured by the dust. In a single season very badly infested 10-year-old apple trees were completely freed from the pest. In another experiment 15 young bearing apple trees were selected and the tobacco dust applied in the same way in June and the treatment repeated in August. In October they were examined and not a single woolly aphis could be found.

In setting out trees, it is advised that the roots be dipped in kerosene emulsion to kill whatever aphides may be present, and that during the first season about a pound of tobacco dust be placed about the tree, increasing this amount each spring until the tree receives about 3 lbs. when 6 years old.

Kerosene emulsion is not considered an advisable remedy on account of the expense involved and the difficulty experienced in making it reach the aphides beneath the large roots.

The cucumber flea beetle as the cause of pimply potatoes, F. C. STEWART (*New York State Sta. Bul. 113, n. s., 1896, pp. 311–317, pl. 1*).—From observations made during 1894–'96, the author concludes that he has definitely determined the cause of the trouble known as pimply potatoes. Minute slender white grubs were found boring into the tubers, roots, and root stalks, which later pupated and appeared as the small black flea beetle (*Crepidodera* (*Epitrix*) *cucumeris*).

Hitherto the larvæ of this insect has been supposed to be a leaf miner, and the observations recorded here are of importance as adding considerably to the knowledge of its habits and life history. Owing to irregularities in the appearance of the disease, it was at first thought that different varieties of potatoes were differently affected, but it was later found that "slivers"[1] without pimples occurred on the same tuber, and it was concluded that in order to produce a pimple the tuber must be attacked at a certain stage of its growth.

[1] The name applied to the wound due to the boring of the grub.

As a remedy for the trouble, protecting the foliage against the attacks of the adult beetles is suggested. This may be done by spraying thoroughly with Bordeaux mixture, to which a little Paris green has been added.

The lesser apple leaf folder and the leaf crumpler, J. M. STEDMAN (*Missouri Sta. Bul. 36, pp. 62–80, figs. 6*).—The author gives here a popular account of the damages committed by these two insects in Missouri during the years 1895 and 1896, of their life histories and habits, and of experiments undertaken to determine the best remedies. Relative to the life history, he brings out the fact that in his breeding cages the insects emerged from the pupal condition uniformly earlier than they were found in the field. As to remedies against the leaf folder, he points out that its life history shows that the most favorable time for attacking it is at the beginning of each of its three broods or before the larvæ have folded the leaves. They then may be very economically destroyed by a spray made of lime and Paris green in the proportions of 1 lb. of the lime and 3 lbs. of the Paris green to 150 gal. water.

The leaf crumpler may be attacked with the same mixture just before the flowers open. In some of the experiments the trees were sprayed a second time just after the blossoms fell, with a weaker mixture (175 instead of 150 gal. water), but no particular advantage appeared to be derived from so doing.

Remedies for insects and fungi, C. W. WOODWORTH (*California Sta. Bul. 115, pp. 15*).—In this popular bulletin the author reduces the subject of remedies against insects and fungi to systematic form, bringing out prominently the fundamental principles of economic entomology. The chief mistakes commonly made in the application of remedies are pointed out.

The insects and fungi are divided into 7 classes according to their mode or places of activity and the proper remedies to be employed in each class noted. The classes are: (1) root feeding, (2) boring, (3) sap sucking, (4) defoliating insects, and (5) external, (6) local, and (7) penetrating fungi. Remedies are also treated separately, as powders, gases, and washes or sprays.

A table showing the ingredients of the common washes and sprays with their proportions calculated in percentages and for 5 and 40 gal. amounts is given. Another table shows the amounts of potassium cyanid to be used on orange trees of varying heights.

The common practice of using hydrocyanic-acid gas stronger for large than small trees is declared to be without reasonable basis. The use of carbon bisulphid against root-eating insects is not considered advisable, since in order to kill the insects it is necessary to use the substance in amounts sufficient to injure the plants.

In a supplement published March 9, 1897, a correction is made as to the amount of water given in a formula for a lime, salt, and sulphur mixture. Ten instead of 60 gal. was the amount intended. The correct proportions are: Lime, 6 lbs.; salt, 2 lbs.; sulphur, 3 lbs.; water, 10 gal.

With this correction are added the following supplementary formulas:

Hilgard's sulphid of potash wash.—Caustic soda (98°), 1 lb.; commercial potash, 1 lb.; sulphur, 3 lbs. Boil together 1 hour and then add 20 lbs. of whale-oil soap dissolved in hot water and boil a half hour. Dilute this mixture to 100 gal. and apply hot.

Pierce's Bordeaux mixture.—Bluestone, 5 lbs.; lime, 10 lbs.; water, 45 gal. Prepare in the same manner as other Bordeaux mixtures. Excellent results have been obtained with this as a remedy for leaf-curl of the peach.

Paris green and Bordeaux mixture.—Paris green may be stirred into the Bordeaux mixture in the usual proportion of 1:200.

New Coccidii of the digestive tube of Myriapods, L. LEGER (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 17, pp. 901–903*).

Descriptive notes on two Coccidæ, T. D. A. COCKERELL (*Ent., 30 (1897), No. 404, pp. 12–14*).—*Lecaniodiaspis celtides* and *Pulvinaria innumerabilis* are described.

Classification of the Orthoptera according to the characters of the digestive apparatus, L. BORDAS (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 15, pp. 821–823*).—The Orthoptera are divided into two suborders, Acolotasia and Colotasia, characterized by the presence in the one and by the absence in the other of intestinal diverticula. The number and disposition of the Malpighian tubes and the internal structure of the so-called gizzard permit of distinguishing the families Phasmidæ, Forficulidæ, Blattidæ, Mantidæ, Acridiidæ, Locustidæ, and Gryllidæ. The first two belong to the Acolotasia, the rest to the Colotasia.

Changes in fauna due to man's agency, T. D. A. COCKERELL (*Nature, 55 (1897), No. 1429, pp. 462, 463*).—The author takes his example from the distribution of Coccidæ.

Evolution of Lepidoptera, G. M. VON LINDEN (*Biol. Centr. Bl., 17 (1897), pp. 179–190, 213–226; abs. in Jour. Roy. Micros. Soc. [London], 1897, No. 3, p. 201*).—A discussion of Eimer's work on the origin of the specis of Lepidoptera.

The biology of plant lice of the subfamilies, Aphididæ and Pemphigidæ, A. MORDWILKO (*Arbeit. Zool. Lab. Univ. Warschau, 1896, pp. 23–146, illustrated [Russian]; abs. in Zool. Centr. Bl., 4 (1897), No. 7, pp. 251–254*).—The forms studied were *Rhopalosiphum ribis, Aphis farfaræ, A. persicæ, A. radicola* n. sp., *A. mali, A. brassicæ, Dryobius roboris, Trama radicis, Schizoneura corni, Pemphigus cærulescens, P. ulmi,* etc. The new species, *A. radicola*, is found in summer on *Rumex crispus* and an undetermined species of Grama. It bears some resemblance to *A. cratægi.*

How flowers attract insects, F. PLATEAU (*Bul. Acad. Roy. Sci. Belgique, ser. 3, 30 (1895), pp. 466–488; 32 (1896), pp. 505–534, pl. 1; 33 (1897), pp. 17–41; abs. in Jour. Roy. Micros. Soc. [London], 1897, No. 2, p. 121; Naturwiss. Rundschau, 12 (1897), No. 32, p. 407*).—Experiments were made chiefly with *Dahlia variabilis, Lobelia erinus, Œnothera biennis, Delphinium ajacis, Ipomœa purpurea, Centaurea cyanus,* and *Digitalis purpurea.* Conclusions adverse to those of Darwin are arrived at. In the case of the Compositæ the removal of the conspicuous ray flowers had little effect in diminishing the number of insects that visited them. Similar results were obtained with other flowers. Covering the flowers with leaves had little effect. The author concludes that insects are attracted to flowers by the sense of smell rather than by that of sight. He further found that the different colors of flowers of the same species seemed equally attractive.

The larval state of Hypoderma bovis, P. KOOREVAAR (*Tijdschr. Nederl. Dierk. Verein., 2. ser., 5 (1896), pp. 29–34*).

Remarkable vitality, C. A. WHITING (*Amer. Nat., 31 (1897), No. 366, p. 452*).—Larvæ of *Ephydra gracilis* were taken from Great Salt Lake, kept for 10 days in salt water, then washed in fresh water and transferred to a 3 per cent solution of formalin, where at the expiration of 10 days 3 were still living. An instance in which the head and thorax of the orthopter, *Stenophelmatus fasciatus*, lived for 9 days is also cited.

High-flat setting, W. H. HARWOOD (*Ent., 30 (1897), No. 408, pp. 142, 143*).—A defense of the British mode of setting insects as against the continental mode. It is argued that British-set insects can be readily relaxed and reset by continental collectors, and that they require very few of them, whereas if the continental mode were adopted in England it would necessarily cause a great amount of labor in resetting insects in English cabinets.

High-flat setting, F. C. WARBURG (*Ent., 30 (1897), No. 405, pp. 45–47*).

Transformations of some North American hawk moths, W. BEUTENMÜLLER (*Bul. Amer. Mus. Nat. Hist., 8 (1896), pp. 291–299*).

The American cockroach (Periplaneta americana) and the means of destroying it, J. RITZEMA BOS (*Tijdschr. Plantenziekten., 2 (1896) pp. 22–27, figs. 5*).

Italian Coccidæ of fruit trees, A. BERLESE (*Pt. I ex Riv. pat. Veg., 2 (1893), pp. 106, pls. 3, figs. 45; Pt. II ex op. cit., 3 (1894), pp. 201, pls. 12; Pt. III ex op. cit., 4–5 (1896), pp. 477, pls. 12, figs. 200; abs. in Jour. Roy. Micros. Soc.* [*London*], *1897, No. 2, p. 121*).—A detailed morphological account of the insects is given.

Wintering bees, A. CRAUSSE (*Rapports Preliminaires 3e Congrès Internat. d'Agr., Bruxelles, 1895, pp. 567–573*).—An article made up of practical general remarks on the subject. Colonies should be at least 5,000 strong, have a fertile and young queen, and be provided with as much as 12 to 15 kg. of stores at the beginning of winter. Defective colonies should be united. Feeding should be done with good honey or sugar sirup, which should be liquid and covered. If not covered, its hydrometric properties will cause it to take up moisture from the hives or it will spoil and give rise to dysentery. The hive should be well ventilated and off the ground. The bees should be quiet during cold weather. Water and pollen are consumed in large quantities in spring and the bees should be aided in obtaining them.

The optic lobes of the bee's brain in the light of recent neurological methods, F. C. KENYON (*Amer. Nat., 31 (1897), No. 365, pp. 369–377, pl. 1*).—Essentially a paper submitted to the American Morphological Society.

The optic lobes of the bee's brain, F. C. KENYON (*Science, n. ser., 5 (1897), No. 115, pp. 429, 430*).—Abstract of a paper submitted to the American Morphological Society at its Boston meeting, 1896. The number of neural elements taking part in the transmission of visual stimuli to the central portion of the brain as well as the fiber tracts into which they are gathered are noted.

Silkworm microbe, L. MACCHIATI (*Bul. Soc. Ital., 1896, pp. 292–297; abs. in Jour. Roy. Micros. Soc.* [*London*], *1897, No. 3, p. 238*).—*Streptococcus pastorianus* is identified with the earlier described *S. bombyces*.

Silk producing Lepidoptera, A. WAILLY (*Ent., 30 (1897), No. 405, pp. 39–44*).—This is continued from volume 39, p. 356, of the journal cited, and deals with European and American species of Attacus, Saturnia, Bombyx, Telea, Platysamia, Callosamia, Phylosamia, Actias, Hyperchiria, and Eucheira.

Growth of silkworms, LUCIANI and LO MONACO (*Atti R. Accad. Lincei, 6 (1897), pp. 155–162; abs. in Jour. Roy. Micros. Soc.* [*London*], *1897, No. 3, p. 201*).—A study of the increase of the nitrogenous content of silkworms in its relation to nutrition at different stages.

A buffalo gnat new to the United States, T. D. A. COCKERELL (*Ent. News, 8 (1897), No. 5, p. 100*).—Swarms of gnats that have been identified as *Simulium ochraceum* Walk. were seen on the campus of the New Mexico Agricultural College June 25, 1895.

The fowl tick, R. HELMS (*Jour. Bureau Agr. W. Australia, 4 (1897), No. 4, pp. 1154–1158*).

The apple worm (Carpocapsa pomonella) and means for its prevention, J. RITZEMA BOS (*Tijdschr. Plantenziekten., 2 (1896), pp. 52–74, figs. 16*).

Asparagus pests, F. H. CHITTENDEN (*Amer. Agr., 59 (1897), No. 25, pp. 733, figs. 4*).—From the U. S. Dept. Agr. Yearbook 1896.

The cankerworm, C. M. WEED (*New Hampshire Sta. Bul. 44, pp. 33–41, figs. 7*).—The cankerworms (*Anisopteryx pometaria* and *Paleacrita vernata*) are noted as injurious during 1897, and after a few historical references, dating back to 1797, the life history of the insects, their enemies, and the well-known remedies for it, such as the use of Raupenleim or dendrolene, spraying with Paris green and kerosene emulsion, are discussed.

The celery fly (Tephritis onopordinis) (*Jour. Hort., 49 (1897), No. 2532, p. 298; reprint from Bd. Agr.* [*London*] *Leaflet 35*).—The remedies noted are burning of affected plants; keeping down thistles, etc. ; pinching affected leaves at beginning; the application of finely powdered soot or lime over plants while dew is on to prevent flies from laying their eggs, or a mixture of soot and lime at the rate of 1 bu. of lime to 3 of soot; and spraying with paraffin and soap mixtures (1 qt. of paraffin oil to 1 lb. of soft soap and 10 gal. of water).

The carrot fly (*Bd. Agr.* [*London*] *Leaflet 38, pp. 3, figs. 4; reprint from Jour. Bd. Agr.* [*London*], *3 (1897), No. 4, pp. 390–393*).

Harmful and harmless garden moths (*Jour. Hort., 49 (1897), No. 2536, pp. 394, 395*).—Several of the common sphinx moths of England are mentioned.

Onion maggot (*Canadian Hort., 20 (1897), No. 4, pp. 158–160*).

The peach tree borer, W. G. JOHNSON (*Amer. Gard., 18 (1897), No. 121, p. 275, fig. 1*).

The San José scale and some other insect pests, C. F. BAKER (*Alabama College Sta. Bul. 77, pp. 27–34*).—This is a brief popular compiled bulletin noting the kind of trees attacked by the insect, its modes of dissemination, its destructiveness, and what to do about it, and has the object in view of warning the fruit growers of Alabama. Rigid measures of exclusion to prevent the further introduction of the scale into the State and the burning of infected stock already within it are recommended.

The tomato worm, grape leaf hoppers, and cabbage worms are very briefly mentioned.

Insects injurious to squashes, I, J. B. SMITH (*Amer. Agr. (mid. ed.), 59 (1897), No. 23, p. 682, figs. 2*).—Notes on the striped beetle, cutworms, and larva of a fly that attacks the seed.

The willow leaf beetle (Chrysomela (Phratora) vitellinæ), G. STAES (*Tijdschr. Plantenziekten., 2 (1896), pp. 92–103*).

Diseases and enemies of the vine in Algeria, E. EICH (*Rapports Préliminaires 3e Congrès Internat. d'Agr., Bruxelles, 1895, pp. 833–837*).—The animal enemies noted are the cockchafer (*Melolontha vulgaris*), larvæ of insects, phylloxera, and grasshoppers. The remedies recommended are gathering and burning infested portions of plants, where this method is applicable, and the use of carbon bisulphid and oils.

FOODS—ANIMAL PRODUCTION.

Dietary studies with reference to the food of the negro in Alabama in 1895 and 1896, W. O. ATWATER and C. D. WOODS (*U. S. Dept. Agr., Office of Experiment Stations Bul. 38, pp. 69, pls. 2, dgm. 1*).—With the coöperation of the Tuskegee Normal and Industrial Institute and the Mechanical College of Alabama 20 dietary studies of 18 negro families were made. Some of the families lived in and near the village of Tuskegee, but the majority were on plantations 2 to 9 miles distant. The region is on the edge of the so-called "Black Belt." While the negroes in the village show to a greater or less extent the influence of the Tuskegee Institute, those in the country live in a very primitive way and are believed to be fair representatives of a large class of negroes in this and other regions. They live usually in log cabins containing 1 or 2 rooms, and the house furnishings, clothing, and cooking are of the simplest kind. The food consists largely of corn meal, fat pork, and molasses. Wheat flour and vegetables are used to some extent, and occasionally a little beef, mutton, or poultry is eaten. Raising cotton is the principal industry, and mortgaging the crop is a very common practice.

The purpose of the studies was to ascertain something of the food and nutrition of typical negro families and to compare the results with similar studies made in other regions. The methods followed were those described in Bulletin 21 of this Office (E. S. R., 7, p. 148). A number of Alabama foods were analyzed and the composition of the others was computed from standard tables.

In the opinion of the authors there would be no serious error in assuming that the quantities of food purchased represented the amounts eaten, and this was done. Tables are given showing in full the results of the dietary studies. The following table gives the quantities and cost of food per man per day, with the fuel value and nutritive ratio:

Results of dietary studies—composition and cost of food per man per day.

	Cost.	Protein.	Fat.	Carbohydrates.	Fuel value.	Nutritive ratio.
Negroes in the Tuskegee region.	*Cents.*	*Grams.*	*Grams.*	*Grams.*	*Calories.*	
Farmer's family	2.25	31	27	304	1,625	1:11.8
Do	4.00	26	83	225	1,800	1:15.9
Do	4.00	33	99	214	1,935	1:13.3
Farmer's family, summer	3.00	44	57	372	2,240	1:11.4
Farmer's family, winter	3.50	35	60	389	2,295	1:15.0
Average	3.35	39	58	380	2,265	1:13.2
Farm manager's family	9.50	49	138	255	2,535	1:11.7
Farmer's family	5.25	49	119	362	2,790	1:12.9
Sawmill laborer's family, summer	6.25	59	85	429	2,790	1:10.5
Sawmill laborer's family, winter	6.00	58	118	390	2,932	1:11.3
Average	5.49	58	101	409	2,860	1:11.1
Farmer's family	4.50	54	85	458	2,890	1:12.1
Do	8.25	71	126	432	3,230	1:10.1
Plantation hand's family	6.25	52	182	324	3,235	1:14.2
Farmer's family	8.00	52	120	467	3,245	1:14.2
Do	9.75	92	124	425	3,270	1: 7.7
Carpenter's family	16.75	97	148	558	4,060	1: 9.2
Woman farmer's family	7.00	77	131	649	4,195	1:12.3
Farmer's family	8.50	86	141	627	4,235	1:11.0
Do	10.25	80	269	518	4.955	1:14.1
Cotton plantation laborer's family	11.25	99	252	666	5,480	1:12.5
Do	12.25	93	283	649	5,670	1:13.9
Average of all	6.57	62	132	436	3,270	1:11.8

The influence of education was shown to be very marked. The negroes in and near Tuskegee lived in much more comfortable circumstances than those in the country, and their diet was more abundant and varied.

"The negro dietaries show on the average a liberal allowance of fuel ingredients in the food as measured by the fuel values. But the quantities of protein are extremely small, in general from one-half to two-thirds the amounts which the standards call for and which are actually found in the food of well-to-do and well-nourished people of different classes in the United States and in Europe. The nutritive ratios of the negro dietaries are very wide as compared with those of both the dietary standards and the actual dietaries of people who are ordinarily assumed to be well nourished."

Dietary studies at the Maine State College in 1895, W. H. JORDAN (*U. S. Dept. Agr., Office of Experiment Stations Bul. 37, pp. 57*).—Dietary studies were conducted at the college boarding house in which the attempt was made to control to some extent the source and supply of animal foods. The object of this was to compare high and low cost foods as the source of protein "with special attention to the influence of the free use of milk as a low-cost animal food upon the character and cost of the dietary." The author points out that milk is a very nutritious and inexpensive article of diet, yet the fact is not generally recognized that its liberal use in the dietary is economical. The opinion is prevalent that the abundant use of milk does not diminish the quantity of other foods consumed.

Five dietary studies were made. The first was under ordinary conditions. In the second the protein was derived from expensive sources, *i. e.*, high-priced meats, fish, and poultry; in the third protein was derived from cheap sources, *i. e.*, low-priced meats, milk, and beans; in the fourth and fifth no departure was made from the ordinary conditions, except in the amount of milk supplied, in the fourth the milk supply being limited and in the fifth very abundant. The methods followed in making the investigation were practically those described in Bulletin 21 of this Office (E. S. R., 7, p. 148). A number of foods were analyzed in connection with the dietary studies. The composition of the others was computed from standard tables.

Tables are given which show the kind and amount of food purchased, wasted, and eaten and its cost, composition, and fuel value. The results are briefly summed up as follows:

Results of dietary studies—food eaten per man per day.

	Protein.	Fat.	Carbohydrates.	Fuel value.
	Grams.	*Grams.*	*Grams.*	*Calories.*
First dietary: Usual food supply	132	147	751	4,990
Second dietary: Costly meats; milk limited	112	164	517	4,105
Third dietary: Milk in abundance; other protein less costly	112	106	530	3,620
Fourth dietary: Milk supply limited	131	181	579	4,595
Fifth dietary: Milk supply unlimited	120	184	436	3,990

The average daily cost per man of the food purchased for the 5 dietary studies was 26 cts., 34 cts., 26 cts., 27 cts., and 25 cts., respectively. The results are discussed in detail.

Among the conclusions drawn were the following:

"The freer use of milk did not, as is supposed by some to be the case, increase the gross weight of food eaten. The extra amount of milk consumed replaced other animal foods to a nearly corresponding extent in the first trial and caused a proportionate diminution in the consumption of vegetable foods in the second study.

"The actual quantity of water-free nutrients eaten diminished rather than increased when more milk was supplied. This is in marked contrast to the apparent effect of the free use of maple sirup, which was accompanied by a notably large consumption of nutrients.

"In both trials the increased consumption of milk had the effect of materially narrowing the nutritive ratio of the dietary, a result which appears to be generally desirable.

"The dietaries in which milk was more abundantly supplied were somewhat less costly than the others and at the same time were fully as acceptable.

"These results indicate that milk should not be regarded as a luxury, but as an economical article of diet, which families of moderate income may freely purchase as a probable means of improving the character of the dietary and of cheapening the cost of their supply of animal foods."

The influence of beer on the nitrogen metabolism of healthy men, E. R. BERTELS (*Zur Frage über den Einfluss des Bieres auf die Stickstoffmetamorphose bei gesunden Menschen. Inaug. Diss. Dorpat, 1897; abs. in Chem. Ztg., 21 (1897), No. 37, Repert., p. 105*).—The author made a number of experiments with healthy men to determine the influence of beer on the metabolism of nitrogen. When beer was consumed the excretion of nitrogen diminished noticeably and quite rapidly. The quantity of urine increased, while the specific gravity diminished. The author concludes that beer should be regarded not only as an alcoholic beverage, but also (on account of the nutritive material which it contains) as a food. The lactic and acetic acids and bitter principle from hops in beer exert a favorable influence on digestion.

The composition of cooked fish, CATHERINE I. WILLIAMS (*Jour. Chem. Soc. [London], 71–72 (1897), No. 415, pp. 649–653*).—The author reports an investigation of the composition of 27 samples of cooked fish and 1 sample of oysters. The fish included among others fresh and salt herring, sardine, California salmon, eel, mackerel, fresh and salt cod, halibut, and soles. They were prepared as for the table by cooking in boiling water, the salt fish being soaked in cold water before cooking. When cold the head, bones, and such portions of the skin of the fish as would ordinarily be rejected at the table were removed, weighed, crushed in a mortar, and boiled in distilled water, the water evaporated to constant weight, and the residue taken as gelatin. The nutrients, water, gelatin, and waste in the fish as served at the table were recorded. Ultimate analyses, including sulphur and phosphorus, and proximate analyses of the samples were made. The heat of combustion was calculated and also determined directly with a Thomson calorimeter.

An interesting feature of the results is the somewhat high percentage of "reducing substances reckoned as glucose" which the author found.

This ranged from 2.17 per cent in the case of smelt to 17.59 per cent in salt herring and 18.32 per cent in oysters. The reducing substances were determined by removing the fat in the samples with petroleum ether and digesting the fish powder with hydrochloric acid on a water bath in a flask with a reflux condenser. The solution was filtered, treated with basic lead acetate, and a current of sulphur dioxid passed through the filtered liquid to precipitate any lead. The solution was filtered and concentrated at 100° C. and a little washed alumina added until it was no longer dissolved. The solution was again filtered, evaporated to dryness on a water bath, treated with boiling alcohol, filtered, and the alcohol distilled off. The residue was dissolved in water, decolorized by boiling with animal charcoal and a few drops of milk of lime, filtered, and titrated with Fehling's solution.

Alfalfa, or lucern: Its chemical life history, I, J. A. WIDTSOE (*Utah Sta. Bul. 48, pp. 75, dgms. 12*).—The author gives analyses of a number of samples of alfalfa—whole plant, leaves, stalks, and flowers, of the first, second, and third crop—and of first, second, and third crop alfalfa hay. The relative value of the different parts of the plant from different crops is discussed, as well as the proper time of cutting alfalfa hay.

The following conclusions are drawn: The total dry matter of the alfalfa crop increases up to the time the tops die down. The greatest gains in dry matter occur during the week between budding and medium bloom. Later the gains are insignificant. The total amount of nitrogen-free extract increases up to the time the tops die down, though the relative amount diminishes as the plants grow older. Both the total and relative amounts of crude fiber increase until the plants die down, the formation being most rapid during the flowering period. The total quantity of albuminoids increases up to the first week of full flowering and decreases after this time. The percentage of albuminoids is greatest in the young plants and decreases as the plants grow older. The nonalbuminoid nitrogenous compounds are rapidly converted into albuminoids at the time of budding. The feeding value of the alfalfa crop does not diminish from the period of budding to that of full flowering.

To obtain the largest yield of dry matter and albuminoids alfalfa should be cut not earlier nor later than the first week of early flowering. This in most cases will be 2 or 3 weeks after the flower buds first appear. The first, second, and third crops have about the same food value, pound for pound. When the alfalfa flowers begin to appear the stalks constitute about 50 or 60 per cent and the leaves 40 or 50 per cent of the whole plant. At the usual time of cutting alfalfa leaves contain one-third or more of the total dry matter of the crop. The leaves contain one-third to one-fourth as much crude fiber as the stalks and 2 or 3 times as much albuminoids.

The digestibility of castor-bean meal from which the poison has been removed, O. KELLNER, A. KÖHLER, W. ZIELSTORFF, and

F. BARNSTEIN (*Landw. Vers. Stat.*, *47* (*1896*), *pp. 332–341*).—An experiment was made with 2 steers to determine the digestibility of castor-bean meal with the poison removed, which was added to a ration of chopped straw in amounts varying from 1 kg. to 3 kg. per day. The coëfficients of digestibility were found to be low, probably owing to the large percentage of seed coat in the meal. It was eaten readily and no bad effects were observed. Very little of any other constituent except protein was digested. The authors suggest that a more digestible feeding stuff could be prepared from castor beans, since the seed coat could be easily removed. Owing to the extremely poisonous properties of castor beans only meal should be used in feeding experiments which is guaranteed to be free from poison, and even in this case the precaution should be taken to feed it in small quantities to some small animal before it is fed to stock.

The effects of consuming the daily food at one time or at intervals, F. VON GEBHARDT (*Arch. gesam. Physiol.* [*Pflüger*], *65* (*1896*), *No. 11–12*, *pp. 611–626*).—A number of experiments were made with a dog. In some cases the daily food was consumed at one meal; in others it was divided into portions and taken at intervals. The nitrogen of the income and outgo was determined. Among the conclusions was the following: When the daily ration is taken in several portions at intervals the organism retains more nitrogen than when it is consumed at one time, although the digestion and intestinal absorption are practically the same in both cases.

The former method of feeding is therefore to be preferred to the latter.

Slaughter experiments of the German Agricultural Society in 1896 (*Arb. deut. landw. Ges.*, *1896*, *No. 18*, *pp. 80; abs. in Milch Ztg.*, *25* (*1896*), *pp. 681–684*).—*Slaughter tests with different breeds of cattle, B. Martiny* (pp. 1–72).—A feeding experiment was made with 3 lots of cattle. The first consisted of 30 Shorthorns, the second of 30 Simmenthalers, and the third of 28 Dutch steers. The cattle were fed for about 5 months. They were given at first a ration consisting of palm-nut meal, cotton-seed meal, wheat chaff, dried beet chips, a little molasses, meadow hay, and barley straw (*ad libitum*). After a short time beet leaves were substituted for the barley straw. During the latter part of the experiment the ration was increased and some potato slump added. The animals were weighed at frequent intervals. The details of food consumed and gains made are given in tabular form. The cattle were slaughtered and the meat cut up and judged. [The method of cutting up the carcasses is not the same as that followed in this country.]

The author concludes that none of the breeds of cattle used could be regarded as making greater or more satisfactory gains than the others, and that the size of the animal or the gains made do not furnish a means of judging the value of the carcass. The experiment indicates the need of more extended work along these lines.

The value of the flesh of fattened pigs, B. Herter (pp. 73–80).—A slaughter test was made with 13 crossbred Berkshire pigs with considerable Meisen blood, all from one litter, and 2 crossbred Berkshire pigs without Meisen blood. Part of the pigs were castrated much later than the other. Several of the sows were spayed. The pigs were fed under the same conditions from birth. They were fattened and slaughtered when about 10 months old.

The results of the experiment confirm the opinion that crossbred swine with a large percentage of English blood are not unfitted for the production of a desirable quality of meat. Spaying had no effect on the growth or quality of the meat.

Experiment to compare the feeding value of dried grains and other home-made fodders with that of linseed cake, MILNE (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 7 (1895) pp. 459-469*).—Three tests were made at Mains of Laithers to compare dried brewers' grains and similar products with linseed cake.

The first test was made with 3 lots of 8 Irish heifers about 2 years old. Each lot was fed about 60 lbs. of ruta-bagas per head, daily. In addition lot 1 was fed 6 lbs. of linseed cake, lot 2 3 lbs. each of dried brewers' grains and decorticated cotton-seed cake, and lot 3 clover and rye grass hay *ad libitum*. The test lasted 14 weeks. Lot 1 gained 1.4 lbs., lot 2 1.54 lbs., and lot 3 0.93 lb. per head daily.

The second test was made with 3 lots of 4 Irish steers, and lasted 10 weeks. All the steers were fed 60 lbs. of ruta-bagas, and in addition lot 1 was given 6 lbs. of linseed cake, lot 2 6 lbs. of dried brewers' grains, and lot 3 3 lbs. each of decorticated cotton-seed cake and barley bran per head per day. Lot 1 made a daily average gain of 1.95 lbs., lot 2 of 2.68 lbs., and lot 3, of 2.06 lbs. per head.

The third test was made with 44 Irish steers divided into 5 lots of 8 each and 1 lot of 4. Lots 1 to 5 were fed 30 lbs. of yellow turnips per head per day and oat straw *ad libitum*. In addition lot 1 was fed linseed cake; lot 2 wet brewers' grains, decorticated cotton seed cake, and linseed cake; lot 3 dried brewers' grains and decorticated cottonseed cake; lot 4 dried brewers' grains (special); and lot 5 meat meal, barley, and linseed cake. The various grain rations were so arranged as to contain approximately equal quantities of nitrogenous material and fat, and 8 lbs. per head daily were fed. Lot 6 was fed barley bran and oat straw. The test lasted 4 months. The composition and cost of the feeding stuffs are given. Lot 1 gained on an average 31.5 lbs. per head per month, lot 2 33 lbs., lot 3 23.5 lbs., lot 4 35 lbs., lot 5 34 lbs., and lot 6 36.5 lbs.

Feeding with linseed cake was found to be the most expensive, the average cost being $1.38 per head per week. The lot fed with the special dried brewers' grains was fed the cheapest, the cost being 93 cts. per head per week.

The conclusion is reached that there is no special value in linseed cake as compared with other concentrated feeding stuffs, and that other and the less expensive feeding stuffs produce as satisfactory gains, and at the same time the animals are in as good condition.

Investigation of the metabolism of matter and energy of steers on a maintenance ration, O. KELLNER ET AL (*Landw. Vers. Stat., 47 (1896), pp. 275–331*).—Two experiments were made with full-grown Bavarian steers to study the metabolism of matter and energy on a maintenance ration. This work is regarded by the authors as preliminary to a series of investigations on the metabolism of steers under various conditions.

In experiment I, which was made with steer A, a daily ration of 8.5 kg. good meadow hay was fed; and in experiment II, which was made with steer B, a daily ration of 5 kg. of oat straw and 4 kg. of the same hay used in experiment I was fed. The food, urine, feces, and respiratory products were analyzed. The respiratory products were measured by the Pettenkofer apparatus. The analytical methods and apparatus were the same as those used by Kühn[1] in his experiment with steers. For some time before the experiment proper was begun the steers were fed the same ration under similar conditions, to accustom them to it. After a preliminary period of 5 days, the experiment lasted 15 days. Five days of this period (not consecutive) were spent in the respiration apparatus. The analytical data are given in full in tabular form. The coëfficients of digestibility of the feeding stuffs were as follows:

Coëfficients of digestibility.

	Dry matter.	Organic matter.	Crude protein.	Protein.	Crude fat.	Nitrogen-free extract.	Crude fiber.
	Per cent	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Meadow hay	64.9	67.1	60.6	73.5	61.0	70.3	63.8
Oat straw	55.1	56.2	2.2	42.1	28.7	55.6	62.4

The balance of income and outgo of nitrogen and carbon was as follows:

Balance of income and outgo of nitrogen and carbon.

	Nitrogen				Carbon.				
	In food.	In urine.	In feces.	Gain + or loss —.	In food.	In urine.	In feces.	In respiratory products.	Gain + or loss —.
	Grams.	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*
Experiment I: 8.5 kg hay, 26 kg. water	116 2	61.3	48.7	+ 6.2	3,354.6	210.4	1,207.0	1,810.0	+127.2
Experiment II. 4 kg. hay, 5 kg. straw, 40 gm. salt, 2621 kg. water	77.1	46.6	45.1	— 14.6	3,554.2	169.1	1,500.1	2,011.6	—126.6

From the balance of nitrogen and carbon the authors calculate that steer A gained 0.039 kg. protein and 0.139 kg. fat, and that steer B

[1] Landw. Vers. Stat., 44 (1894), pp. 257–581 (E. S. R., 6, p. 72).

lost 0.091 kg. protein and 0.102 kg. fat. The fuel value of the food, urine, and feces was determined by the bomb calorimeter. A considerable portion of the crude fiber and ether extract of the food and feces was prepared and the fuel value determined. It was found that the fuel value of crude fiber and ether extract was somewhat different in the materials prepared from the two sources. Taking into account these values and previous work, the fuel value of digestible crude fiber was calculated to be 4.219 calories, of ether extract 8.322 calories, and of nitrogen-free extract 4.232 calories per gram.

Taking into account the fuel value of food and excretory products, and of the gain or loss of body tissue, the balance of income and outgo of energy in the two experiments was determined. (The balance is not complete, since the author did not measure the energy liberated as heat or used for external muscular work.) The fuel value of these factors was as follows:

Fuel value of food actually consumed, excretory products, and tissue gained and lost in experiments with steers.

	Income.	Outgo.
Experiment I:	*Calories.*	*Calories.*
Meadow hay (7,263 gm.)	32,177.3	
Feces (2,547 gm.)		11,750.3
Urine, dry matter (633.7 gm.)		1,945.0
Methan (158.4)		2,098.2
Protein tissue gained (39 gm.)		220.5
Fatty tissue gained (139 gm.)		1,320.5
Total outgo and stored material		17,334.5
Balance	14,842.8	
Experiment II:		
Meadow hay (3,494 gm.)	15,426.4	
Oat straw (4,146 gm.)	18,368.0	
Feces (3,086 gm.)		14,576.1
Urine, dry matter (542.5 gm.)		1,549.4
Methan (174.7 gm.)		2,314.1
Protein tissue from body	405.3	
Fatty tissue from body	969.0	
Total outgo		18,439.6
Balance	16,729.1	

From their own experiments, and from experiments by Kühn, the authors calculate that for steers 24,000 calories of energy per day per 1,000 kg. live weight are necessary for maintenance, and that the nutritive elements of hay of fair quality and similar feeding stuffs furnish about 3.5 calories per gram.

Feeding for beef, E. R. LLOYD and J. S. MOORE (*Mississippi Sta. Bul. 39, pp. 157–166*).—An experiment divided into 2 periods was made with 30 Texas and 28 native steers to test the value of shredded corn fodder and jack bean (*Canavalia ensiformis*), and to compare them with rations of ordinary hays and cotton-seed meal. The Texas steers, 3 and 4 years old, were divided into 6 lots of 5 each; and the natives, 2 and 3 years old, were divided into 4 lots of 5 each and 2 lots of 2 each. The Texas steers were dehorned. For 3 months before the test they had been pastured and fed cotton-seed meal in addition. The native steers had been fed in a pen. The first period began November 21 and continued 44 days. The lots of Texas steers are numbered 1 to 6, inclusive, and the lots of natives 7 to 12, inclusive. The following rations were fed:

Lots 1 and 7, shredded corn fodder, cotton-seed meal, and silage.
Lots 2 and 8, shredded corn fodder, cotton-seed meal, silage, and jack bean meal.
Lots 3 and 9, crabgrass hay and cotton-seed meal.
Lots 4 and 10, crabgrass hay, cotton-seed meal, and jack bean meal.
Lots 5 and 11, cowpea hay and cotton-seed meal.
Lots 6 and 12, red clover hay and cotton-seed meal.

Analyses of the feeding stuffs are given. The average weight of the Texas steers at the beginning of the trial was 704.8 lbs., and of the natives 445.4 lbs. Lots 1 and 7 made a daily gain of 1.07 lbs., while lots 2 and 8, fed jack-bean meal in place of part of the cotton-seed meal, gained only 0.53 lb. per day. Lots 3 and 9 gained 1.57 lbs. daily, while lots 4 and 10, receiving a similar ration with jack bean in addition, gained only 0.77 lb. Lots 5 and 11, receiving cowpea hay, gained 1.37 lbs. daily, while lots 6 and 12, fed red clover hay, gained 2.63 lbs.

The second period, which began immediately after the close of the first period, covered 32 days in the case of the Texas steers and 12 days with the natives, when the lots were considered ready for market. The grain ration fed was the same as in the first period. The lots which had been fed corn fodder and silage were given crab grass instead, and *vice versa.* The lots which had been fed cowpea hay and clover hay received larger quantities of cotton-seed meal, otherwise the ration was unchanged. In this period lots 1 and 7 made an average daily gain of 0.77 lb., lots 2 and 8 of 0.48 lb., lots 3 and 9 of 1.3 lbs., and lots 4 and 10 of 1.02 lbs. With a heavier grain ration lots 5 and 11 made an average daily gain of 2.18 lbs. and lots 6 and 12 of 0.98 lb. The increased grain ration "was evidently greater than the animals were able to assimilate, though none of them showed any indications of scouring or other digestive trouble."

The following conclusions were reached: Shredded corn fodder should be mixed with silage or other similar feed to make it more palatable. It is inferior to crab grass, peavine, or red clover hay, though the fact that it is cheaper compensates in part for the difference in feeding value. Cowpea hay is not equal to red clover hay, which gave the most profitable gains. Jack-bean meal was not eaten with relish by the animals, and in the author's opinion is so indigestible as to be worthless.

Fattening calves, O. D. V. (*Orgaan Ver. Oudleer. Rijks. Landwbouwschool, 9 (1897), No. 2, pp. 8–11*).—An experiment was made with 4 calves, A, B, C, and D, to find a substitute for whole milk which would be cheaper and give as good results. It has been found that centrifugal skim milk did not give good results. Calves A, B, and C were fed colostrum for 8 days and then skim milk for about 3 weeks. The author found that the feces did not vary in composition after the first 2 or 3 days.

At the beginning of the test proper calf A was about 7 weeks old and calves B and C about 5 weeks old. The test was divided into 5 periods of about 8 days each. In the first, third, and fifth periods the daily ration consisted of 15 kg. of skim milk. In the second period sufficient whole milk to furnish 300 gm. of fat was substituted for a part of the skim milk. In the fourth period 300 gm. of potato starch was added to the skim milk. In the case of calf D the test was divided into 3 periods of about 8 days each. In the first and third periods whole milk was fed and in the second period whole milk and potato starch. The calf was about 6 weeks old at the beginning of the test.

The urine and feces were carefully collected and analyzed. Calf A was kept in a dark warm stall and calves B and C in a sheep barn. The milk used was pasteurized and fed at a temperature of 36°. Calf D was fed from a nipple and the others from a pail. The starch was cooked with the milk to form a thick paste. The results for a number of the periods are expressed in tabular form.

It was noticed that when skim milk and whole milk were fed in equal quantities the calves did not do well. The largest proportion of skim milk which could be advantageously fed was 7:1. The average digestibility of skim milk was found to be as follows: Dry matter 95.47 per cent, protein 95.53, fat 95.97, milk sugar 97.30, and ash 83.72. The author remarks that the coëfficients of digestibility agreed very well among themselves, showing that the age of the calf has little effect upon the digestibility of the constituents of skim milk. The figures for ash show variations beyond those within the limits of error. This is explained by the fact that the older the calf the less lime it requires. Therefore as age increased the digestibility of ash diminished. There were no marked variations in the digestibility of the constituents of skim milk in the periods when fat was added, the milk sugar being digested a little less and the milk fat a little more completely. When starch was added the digestibility of protein diminished. The digestibility of starch was estimated to be 93.53 per cent, or as high as in full-grown animals.

The balance of the daily income and outgo of nitrogen, which is given for a number of periods, was as follows:

Balance of income and outgo of nitrogen in calf-feeding experiments.

	In food.	In urine.	In feces.	Gain.
Calf A:	*Grams.*	*Grams.*	*Grams.*	*Grams.*
Period 1 (skim milk)	71.86	48.04	3.22	20.60
Period 2 (whole milk and skim milk)	71.72	40.89	3.57	27.26
Period 3 (skim milk)	71.55	49.72	3.02	18.81
Period 4 (skim milk and starch)	69.23	39.90	5.51	23.82
Calf B: Period 1 (skim milk)	67.50	35.63	2.85	29.02
Calf C:				
Period 1 (skim milk)	66.65	36.61	3.30	26.74
Period 2 (whole milk and skim milk)	64.86	44.06	2.95	17.85

In the case of calf D the income of nitrogen and the outgo in the feces are not recorded. The amount of digested nitrogen was 38.58 gm. in the first period, 39.9 gm. in the second period, and 38.39 gm. in the third period. The amount of nitrogen excreted in the urine in the corresponding periods was 13.54 gm., 20.5 gm., and 18.2 gm., respectively. There was a gain of nitrogen in the 3 periods of 25.04 gm., 16.40 gm., and 20.28 gm., respectively.

Soxhlet's experiments with sucking calves[1] are discussed at length. From his own experiments the author concludes that the exclusive feeding of skim milk does not furnish protein in an economical manner. The addition of 100 gm. of starch to the daily ration served to protect 17.6 gm. of protein. Fat is a much better protector of protein in the calf than in the full-grown animal. The addition of fat to skim milk for fattening calves is recommended, though the author does not believe that the best substitute for whole milk has been found.

The influence of oxalic acid in feeding stuffs, I, S. VON NATHUSIUS (*Ztschr. Ver. Rübenz. Ind. deut. Reichs, 1897, No. 494, pp. 299–331*).—Beet tops as a feeding stuff have often been found injurious. This has been attributed to the oxalates which the leaves contain. To test the effect of oxalic acid experiments were made with Haidschnucker sheep, 1 ram and 3 ewes.

In the experiment with the ram the balance of income and outgo of calcium oxid, and in a number of cases of nitrogen, was determined, in addition to the amounts of food consumed and the gains or losses in weight. The ram was fed a basal ration of 200 gm. of dry beet chips and 500 gm. of hay per day. The experiment was divided into 11 periods. In 3 periods 20 gm. of oxalic acid, half neutralized with sodium carbonate, in the form of a 10 per cent solution; in 2 periods 20 gm. of oxalic acid neutralized with calcium carbonate; in 1 period 20 gm. of oxalic acid, and in 2 periods 15 to 25 cc. of lactic acid were added to the basal ration. In 3 periods the basal ration was fed without the addition of oxalic or lactic acid. In 2 of these periods, however, sodium chlorid was given. The balance of income and outgo of nitrogen and calcium oxid is given in the following table:

Results of feeding oxalic acid to a sheep.

	Length of period.	Nitrogen.				Calcium oxid.			
		In food.	In urine.	In feces.	Gain+ or loss—.	In food.	In urine.	In feces.	Gain+ or loss—.
	Days	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*
Beet chips and hay	*a* 6	8.14	3.64	3.75	+0.75	8.95	0.14	8.37	+0.44
Do	5	9.79	3.91	3.75	+2.13	11.43	.12	9.58	+1.73
Do	5	9.64	4.17	3.58	+1.89	11.26	.51	10.09	+ .66
Average	....	8.86	3.91	3.69	+1.59	10.55	.26	9.35	+ .94

a The nitrogen balance was determined for 5 days only.

[1] F. Soxhlet: Untersuchungen über den Stoffwechsel des Saugkalbes. Wien, 1878, pp. 54. See also Erster Bericht über Arbeiten der k. k. landw. chem. Vers. Stat. in Wien aus den Jahren 1870–'77.

Results of feeding oxalic acid to a sheep—Continued.

	Length of period.	Nitrogen.				Calcium oxid.			
		In food.	In urine.	In feces.	Gain+ or loss—.	In food.	In urine.	In feces.	Gain+ or loss—.
Beet chips and hay, with 20 gm. oxalic acid, half neutralized with sodium carbonate	*Days.* 7	*Grams.* 7.69	*Grams.* 3.07	*Grams.* 3.04	*Grams.* +1.58	*Grams.* 9.57	*Grams.* .20	*Grams.* 8.85	*Grams.* + .52
Do	4	9.76	4.36	3.89	+1.51	11.42	.11	11.42	— .11
Do	5	9.58	4.13	3.85	+1.60	11.22	.10	11.65	— .33
Beet chips and hay, with 20 gm. oxalic acid, neutralized with calcium carbonate	5	9.77	3.73	4.42	+1.62	20.14	.11	19.03	+1.20
Do	6					20.24	.09	20.22	— .07
Average						20.19	.10	19.62	+ .56
Beet chips and hay, with 20 gm. oxalic acid	5					11.45	.36	11.20	— .11
Beet chips and hay, with 15 to 25 cc. lactic acid	4					11.25	.27	9.72	+1.26
Do	5					11.30	.31	10.34	+ .65
Average						11.28	.29	10.03	+ .96

When oxalic acid was fed the sheep lost little calcium oxid. Partially neutralizing the oxalic acid with sodium carbonate did not change its effect. In 2 of the 3 periods in which this was done there was a loss of calcium oxid and in the other a gain. In the author's opinion the latter case is exceptional, and is left out of account in drawing the conclusions. When the oxalic acid was neutralized with calcium carbonate the sheep gained calcium oxid. Lactic acid had no effect on the excretion of calcium oxid. The digestibility of protein was diminished by adding oxalic acid to the ration.

A feeding experiment was made with 3 ewes. No determination of the balance of income and outgo of calcium oxid and nitrogen was attempted. All the sheep were fed a basal ration consisting of 200 gm. of dry beet chips and hay. The calcium oxid in the beet chips and hay was determined. The amount of food actually consumed each day was recorded. The amount of hay was on an average 354 gm., 175 gm., and 209 gm. for the 3 ewes, respectively. In addition No. 1 was given 50 cc. of a 10 per cent solution of oxalic acid neutralized with bicarbonate of soda, and No. 2 the same amount neutralized with calcium carbonate, and No. 3 the same amount half neutralized with calcium carbonate. The amount of calcium oxid consumed by the 3 sheep was calculated. None of the sheep showed symptoms of disease.

The author attributes the fact that the oxalic acid had so little effect in part to the breed of sheep selected for the experiments.

Feeding experiment to determine the relative value of linseed cake and dried distillery grains as a by-fodder for sheep, A. Logan (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 7 (1895), pp. 433–436*).—A test was made at Ferney Castle, Reston, Berwickshire, with 2 lots of 10 sheep each, to compare dried distillery grains and Harburg linseed cake. The test began January 1, 1895, and lasted 62 days. Both lots were fed turnips, and in addition one lot received 1 lb. per head per day of distillery grains and the other lot the same quantity of linseed cake. The composition and cost of the feeding stuffs is given.

The lot fed distillery grains gained on an average 2⅝ lbs. per head more than the lot fed linseed cake. The sheep were slaughtered and the amounts of carcass and tallow recorded. The carcasses of the grain-fed lot were the heavier. The cake was more expensive than the distillery grains.

"The grain-fed lot made most progress during the first month and the cake-fed lot did the best during the second. It is probable that if the experiment had lasted another month the cake-fed lot would have made up on the others."

Experiments on the comparative value of beet diffusion residue silage and Tankard fodder beets, P. GAY and E. FLÉ (*Ann. Agron., 23* (*1897*), *No. 4*, *pp. 145–169*).—The relative value of beet diffusion residue silage and fodder beets is discussed, and analyses are given of the fresh diffusion residue and of the silage.

Experiments to test the relative feeding value of this silage and fodder beets were made with sheep and a milch cow. Ten Dyshley-Merino sheep were divided into 2 uniform lots of 5 each, weighing 250 lbs. and 268 lbs., respectively. The test consisted of 2 periods separated by 4 days. The first period began January 14, 1896, and covered 14 days. It was preceded by a short preliminary period. Both lots were fed a basal ration of 500 gm. field peas, 500 gm. oat straw, and 24 gm. wheat chaff per head, daily. In addition lot 1 received 3 kg. of Tankard fodder beets, and lot 2 4.5 kg. of beet diffusion residue silage. The rations for the two lots contained practically the same amount of dry matter and nutritive ingredients. Lot 1 gained 19.5 kg. and lot 2 11.5 kg.

The second period began January 5 and lasted 13 days. The same basal ration was fed as during the first period. In addition lot 1 was given the silage and lot 2 the fodder beets. At the beginning of the period the lots weighed 264 kg. and 280.5 kg., respectively. Lot 1 lost 5 kg. and lot 2 2 kg. During the whole test there was a difference of 11 kg. in favor of the silage.

The relative value of these two articles for milk production was tested with a milch cow. She was fed a ration of 3.8 kg. of hay, 975 gm. of middlings, 2 kg. of oat straw, and 45 kg. of beets; and during 7 days the amount and composition of the milk was determined. Afterwards the silage was gradually substituted for beets until 60 kg. per day was consumed. This quantity of silage contained the same amount of dry matter as 45 kg. of beets. During 7 days the amount and composition of the milk was again determined.

The principal conclusions reached were the following: Taking into account transportation, the diffusion residue silage costs more than the fodder beets. Pound for pound, the dry matter of the silage was shown to be superior to the fodder beets for fattening animals. This superiority more than makes up for the difference in cost. No harm results from feeding milch cows diffusion residue silage if it has not undergone putrefactive fermentation, which affects its quality. Good silage has no effect on the quantity or quality of milk.

Feeding millet to horses, T. D. HINEBAUCH (*North Dakota Sta. Bul. 26, pp. 89–105*).—Two tests were made with horses to study the effect of feeding millet as a coarse fodder. In the first trial 2 geldings in good health were fed hay and grain for about 2 weeks. Millet was then substituted for hay for about 10 days. The same ration as at the beginning was then fed for 4 days. The temperature of the air, the temperature of the horses, the amount of food and water consumed, the weight of the horses, and the amount of urine excreted were determined. During a number of days the specific gravity, and in some cases the total solids, nitrogen, and ash in the urine were determined. All the horses were driven daily for exercise.

The second test was similar to the first, and was made with 2 mares. One of the mares became very lame and could hardly stand, and suffered from time to time from retention of the urine. She was killed and a *post-mortem* examination of the carcass was made. The other mare did not show as marked symptoms during the test. However, when fed millet for about 3 months she would become so lame in the joints of the hind legs that it was almost impossible for her to walk. When feeding millet was discontinued she would recover. The lameness was again produced by millet feeding. After about 2 years of alternate periods of millet and hay feeding, she became practically worthless. Circular letters were sent out to farmers asking for information concerning millet feeding for horses. A number of replies were received. From his experiments and observations the author draws the following conclusions: Feeding millet alone as coarse fodder is injurious to horses. It produces an increased action of the kidneys and causes lameness and swelling of the joints. It causes an infusion of blood into the joints and destroys the texture of the bone, rendering it soft and less tenacious, so that the ligaments and muscles are easily torn loose. The experience of many farmers confirms the experiments.

The taste of food, W. BARNES (*Dietet. and Hyg. Gaz., 13 (1897), No. 7, pp. 481–483*).—The importance of flavor in food is discussed from a medical standpoint.

Contaminated meat (*Dietet. and Hyg. Gaz., 13 (1897), No. 7, pp. 439, 440*).—In an article quoted from the Medical Chronicle it is pointed out that, in addition to parasites present before slaughtering or added poison, meat may become poisonous in three ways, (1) by the presence of disease at the time of slaughtering, (2) by microörganisms which attack the meat or develop in it after slaughtering, and (3) owing to the presence of ptomaines or tox-albumoses. The need of cleanliness and thorough cooking is insisted upon, as well as inspection of the meat supply.

A study of the composition of wheats and their analysis, A. GIRARD (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 17, pp. 876–882*).—The author believes that wheat should be separated into its different milling products before analysis, and the ratio of glutenin to gliaden determined, if the analyses are to be of value for bakers.

On rye, BALLAND (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 13, p. 709*).—Results of analyses are given.

Dried beer grains as cattle food, W. H. ROBERTSON (*U. S. Consular Rpts., 54 (1897), No. 202, pp. 389–392*).—The author discusses the value of brewers' grains as a cattle food and urges that such grains be used at home rather than exported.

Leaf forage and its use, M. DMITRIEV (*Selsk. Khoz. Lyesov., 183 (1896), pp. 771–815*).—Notes on a feeding stuff consisting of leaves, twigs, etc., of trees and shrubs.

Analyses of swedes grown by members of the Carse of Gowrie and Dundee District Farmers' Club, A. P. AITKEN (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 9 (1897), pp. 291–296*).

The value of fruit and vegetables as part of an every-day diet, W. R. LAZENBY (*Dietet. and Hyg. Gaz., 13 (1897), No. 7, pp. 432–435*).—This article is from an address read before the New York Horticultural Society.

The primary digestion products of protein, F. KUTSCHER (*Ztschr. physiol. Chem., 23, No. 2, pp. 115–120*).

Contribution to the study of artificial digestion with pepsin, F. KLUG (*Arch. gesam. Physiol. [Pflüger], 65 (1896), No. 5–6, pp. 330–342*).

The preparation of "humanized" milk, H. STACEY (*Dietet. and Hyg. Gaz., 13 (1897), No. 7, pp. 435–437*).—An article quoted from the American Druggist.

The influence of the consumption of sugar on the production of muscular energy by man (*Deut. Zuck. Ind., 12 (1897), Nos. 15, pp. 560, 561; 16, pp. 592, 593*).—Brief notes are given on experiments by Zuntz and Schumburg on the influence of sugar on muscular energy. The subject of the experiments was a man, and the amount of work done was measured with a Mosso's ergograph. The conclusion was reached that sugar, even when taken in as small quantities as 30 gm., restores exhausted muscle so that it is capable of performing more work.

The metabolism of the child from birth to the completion of growth, W. CAMERER (*Der Stoffwechsel des Kindes von der Geburt bis zur Beendigung des Wachstums. Tübingen: H. Laupp, 1896, pp. 160, 2. ed. enlarged*).—This book is largely based on experiments made by the author.

Determination of the surface areas of the human body; its grossness, and chemical composition, C. BOUCHARD (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 16, pp. 844–851*).—Formulæ are given for calculating the above-mentioned factors.

The mechanical work performed by muscles, A CHAUVEAU (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 12, pp. 596–602*).—This article, which is in continuation of previous work, gives an account of experiments with frog muscles freshly isolated.

On the nitrogen content of blood when fasting, F. N. SCHULZ (*Arch. gesam. Physiol. [Pflüger], 65 (1896), No. 5–6, pp. 299–307*).

Fat formation in the animal body: An account of experiments on the sources in their food of the fat formed by oxen, J. HENDRICK (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 8 (1896), pp. 225–251, figs. 4*).—The author gives an extended account and discussion of the respiration experiments with steers made by Kühn and his associates (E. S. R., 6, p. 72).

Crossbreeding and selection, J. LEYDER (*Rapports Préliminaires, 3e Congrès Internat. d'Agr., Bruxelles, 1895, pp. 561–566*).

The feeding of animals for the production of meat, milk, and manure and for the exercise of force, Sir J. B. LAWES and Sir J. H. GILBERT (*Trans. Highland and Agl. Soc. Scotland, 1895, pp. 255–354, dgms. 2*).—This is practically the same as an article under the same title published in Bulletin 22 of the Office of Experiment Stations (E. S. R., 7, p. 415).

Wensleydale sheep, their origin and leading characteristics, W. PARLOUR *Trans. Highland and Agl. Soc. Scotland, 5. ser., 9 (1897), pp. (60–73, figs. 3*).

Half-breed sheep, A. GUILD (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 9 (1897), pp. 217–225, fig. 1*).

A chapter of Shorthorn history—early types of the breed, W. PARLOUR (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 8 (1896), pp. 115–127, pls. 8*).

Border Leicesters; short notes on their origin, breeding, rearing, and judging, W. S. FERGUSON (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 8 (1896), pp. 127–139, figs. 2*).

Does pregnancy diminish the value of the flesh of swine? OSTERTAG (*Ztschr. Fleisch- u. Milchhyg., 7 (1897), No. 9, pp. 174–177*).—The author's conclusion is that pregnancy does injure the quality of the meat.

Famous Clydesdale sires, A. MACNEILAGE (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 9 (1897), pp. 123–152, figs. 11*).

British breeds of ponies, W. S. DIXON (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 9 (1897), pp. 196–217, figs. 4*).

The hackney horse, H. F. EUREN (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 8 (1896), pp. 144–179, figs. 7*).

Poultry on the farm, E. BROWN (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 9 (1897), pp. 87–106, figs. 12*).—A popular article on the subject.

Present state of the poultry industry in the middle zone of European Russia, Prince S. URUSOV (*Selsk. Khoz. Lyesov., 183 (1896), pp. 609–645*).

Chickens, J. A. MYERS (*West Virginia Sta. Bul. 45, pp. 329–405, figs. 22*).—A popular bulletin on breeds, care and feeding of chickens, parasites, diseases, etc.

DAIRY FARMING—DAIRYING.

On the constitution of the fat globules of cows' milk, V. STORCH (*36te Beretn. fra den Kgl. Vet.-og. Landbohojsk. Laborat. for landök. Forsög, Copenhagen, 1897, pp. 58–87*).—This volume gives a full account of the investigations conducted by the author during the past 5 years primarily for the study of certain butter faults and their causes. The report is divided into 5 parts, viz, (1) comparative investigations of the microscopic constitution of butter with or without certain faults in consistency (grain); (2) chemical investigations of the butter serum; (3) investigations of the constitution of fat globules; (4) investigations on the cause of the appearance of certain faults in the consistency (grain) of butter; and (5) appendix.

In a limited space it is impossible to give a complete résumé of the mass of original data given in the report, and only the part touching upon the constitution of fat globules will here be referred to in detail, this being of general interest and of fundamental importance to students of dairying.

The author believes that his results prove the existence of a slimy albuminous membrane around the fat globules, and gives strong arguments in favor of the theory. As previously shown by Müller,[1] and later by Kreusler, Kern, and Dahlen,[2] he found that the serum of cream is more concentrated than that of skim milk, and that it contains more albuminoids but not more sugar than the latter. Müller also showed that more of the solid serum constituents of cream go over into the butter than into the buttermilk. In studying this subject

[1] Landw. Vers. Stat., 1863, p. 161. [2] Landw. Jahrb. 4, p. 249.

the author washed cream repeatedly with 4 times its volume of a 33 per cent sugar solution, each time allowing the cream to rise and drawing off the watery layer from below. The washing was repeated 4 or 5 times, viz, until the bottom layer was perfectly clear. The fat globules of the cream obtained by this treatment did not dissolve in ether, even after 1 to 2 hours' continued shaking; a gelatinous mass separated out on top of the cream-ether mixture on standing, but on addition of a few drops of acetic acid or alcohol the fat was dissolved forming a clear yellowish solution.

Cream was treated in a similar manner by several other methods, viz, by washing in a separatory funnel (1) with water warmed to 35° C.; (2) with a 10 per cent sugar solution (specific gravity 1.036, the same as that of milk serum); (3) with water at ordinary temperature; (4) in a centrifuge with water of different temperatures or with sugar solutions. The washing was repeated 4 or 5 times, and the washed cream thus obtained furnished the material for isolation and study of the gelatinous albuminoid matter accompanying the fat globules.

The method of preparation of this albuminoid was as follows: The washed cream was shaken with an equal quantity of alcohol, and a double quantity of ether was then added. On standing, a clear fat solution formed and below it a fairly clear alcoholic liquid containing a gelatinous mass which was easily separated by filtration. The precipitate was washed on the filter with alcohol and afterwards with ether. It dries at ordinary air temperature to a floculent, light, and very hygroscopic powder of a grayish-white color. It is insoluble in water, alcohol, and ether, and shows characteristic reactions different from those of albumen, fibrin, casein, or globulin. The following table gives the results obtained by the author as to the solubility of this and other albuminoids in various reagents:

Reactions of albuminoids.

	Boiling with hydrochloric acid.			
	18 per cent acid.		Concentrated acid.	
	Solubility.	Color of solution.	Solubility.	Color of solution.
Serum globulin (horses' blood)	Easily soluble.	Dark violet-red, green fluorescence.	Easily soluble.	Dark violet-red, green fluorescence.
Serum albumen (horses' blood)	Difficultly soluble.	Dark brown-yellow.	do	Brown-yellow.
Fibrin (swine blood)	Easily soluble.	Almost colorless (yellowish).	do	Yellowish.
Egg albumen	Difficultly soluble.	do	do	Violet-red.
Lactalbumen (cows' milk)	do	Faintly violet-red.	do	Violet-reddish brown.
Casein (cows' milk)	Easily soluble.	do	do	Yellowish.
Albuminoid of fat globules (cows' milk).	Very difficultly soluble.	Violet-reddish brown.	Very difficultly soluble.	Light yellowish.

Reactions of albuminoids—Continued.

	Boiling with strong sulphuric acid.		Boiling with weak soda solution.
	Solubility.	Color of solution.	Solubility.
Serum globulin (horses' blood)	Easily soluble.	Dark red-brown, green fluorescence	Difficultly soluble.
Serum albumen (horses' blood)	do	Dark-brown, slightly fluorescent	Easily soluble.
Fibrin (swine blood)	do	do	Do.
Egg albumen	do	Brown (faintly reddish)	Do.
Lactalbumen (cows' milk)	do	Light brown	Difficultly soluble.
Casein (cows' milk)	do	Light brownish-yellow, strongly fluorescent.	Very easily soluble.
Albuminoid of fat globules (cows' milk).	do	Dark reddish brown	Very difficultly soluble.

The nitrogen content of the albuminoid of the fat globules was found to lie between 14.20 and 14.79 per cent. The following data are given for other albuminoids: Serum globulin, 15.85 per cent; serum albumen, 16.04 per cent; fibrin, 16.91 per cent; egg albumen, 15.25 per cent; casein, 15.70 per cent; lact albumen, 15.77 per cent. Heated for a time with dilute hydrochloric acid, a substance is formed in case of the albuminoid of the fat globules which reduces copper oxid in alkaline solutions, viz, about 6.5 (6.24–6.88) parts of reduced copper per 100 parts of ash-free substance. This reaction is not given by albumen or casein, but by serum globulin (Morner), the glycoproteids, and several muscle proteids (Hammersten).[1]

The author believes this albuminoid firmly adheres to the fat globules as a membranous covering. He rejects Danilewsky and Radenhausen's theory[2] of an albuminous stroma of the globules. He succeeded in coloring the membrane by the following method of procedure: About 50 cc. of washed cream was mixed with 200 cc. of a highly colored solution, picrocarmin or nigrosin giving particularly satisfactory results. The mixture was left to cream in a tall cylindrical separatory funnel; after 24 hours a fairly thick layer of cream had usually separated out, and this was of a lighter color than the staining solution used. The lower liquid containing the small fat globules was placed in another separatory funnel, and left to cream once more. The cream was diluted with 4 times its volume of a 10 per cent sugar solution, mixed, and left to rise, after which the colored solution was drawn off from below and the cream washed with new sugar solutions until this did not show any color on being mixed with the cream and left standing. The cream thus obtained had, in case picrocarmin solution was used, a pink color, and could be mixed with water without imparting any color to the water. No color could be distinguished under the microscope. When shaken with alcohol and ether, the fat was dissolved from the cream thus prepared, and the albuminoid thrown down as a highly red-colored precipitate.

The cream obtained from the portion containing the small fat globules

[1] Lehrb. physiol. Chem., 1895.
[2] Forsch. Geb. Viehhaltung, 1880, No. 9.

was treated in a similar way as above stated, and washed with sugar solution until the washings were not colored. The washed cream thus obtained was more highly colored than the first portion, being of a dark-red color. Microscopic examinations showed that the fat globules, while themselves colorless, were surrounded by a narrow, faintly red-colored border.

With nigrosin the washed cream of the first portion assumed a light bluish gray color, and that from the second portion a darker color. The globules in the latter appeared under the microscope surrounded by a narrow bluish-violet border.

An experiment was made on the churning qualities of washed cream. It was found that it churned in a manner similar to ordinary cream; the butter came after 30 minutes, and the buttermilk separated as usual. The quality of the butter was poor, its flavor being very tallowy. Chemical analysis of the butter showed the following composition: Water 14.67 per cent, fat 84.82, nitrogeneous substance 0.35. (nitrogen 0.049 per cent), ash 0.02, nitrogen per 100 parts of fat, 0.058 parts, and albuminoids 0.412 parts.

The author believes that the membrane is more condensed or viscous nearest to the globules, becoming more watery toward the circumference, and that in separating milk by centrifugal power, as by other violent treatment, a part of this outer covering is loosened from the globules. He finds by calculations based on specific-gravity determinations that the average thickness of the membrane is 0.104 of the radius of the fat globules, and that the fat globules are composed of 72.5 per cent pure fat and 27.5 per cent albuminous membrane.

The term "serum difference," viz, the difference between the composition of the butter serum and the serum of the buttermilk from the same churnings, corresponds to what the author[1] in 1883 called "casein hydrate," which he then believed was formed during the churning process but now shows to be present in the milk and carried over into the cream and the butter with the fat globules. This "serum difference," in the author's opinion, is identical with the slimy membrane of the fat globules. While the "serum difference" of sour-cream butter includes more albuminoid matter than that of sweet-cream butter, the composition of the "serum difference" of either kind is quite constant. The following statement shows the average data obtained from 24 experiments:

Composition of "serum difference."

	Sweet-cream butter.	Sour-cream butter.
	Per cent.	*Per cent.*
Albuminoid matter	6.42	7.49
Ash	1.03	1.09
Water	92.55	91.42
Total	100.00	100.00

[1] Investigations on the formation of butter by churning, and of the physical and chemical composition of butter. Rpt. Expt. Sta., Copenhagen, 1883.

The "serum difference" of butter serum was found to average as follows: In sweet-cream butter 50 per cent, in sour-cream butter 45 per cent; or, 8.45 and 8.16 parts per 100 parts of sweet and sour-cream butter, respectively. According to the calculations made, a little over 60 per cent of the albuminoids contained in butter belong to this "serum difference" or the membranes of the fat globules. The author explains the presence of the minute serum particles in the butter by a general breaking up of the membranes during the churning, particles of these being distributed in the butter in immense numbers. The serum drops, of which there are about 3 to 4 millions per cubic millimeter of butter in faultless goods ("clear" butter) and toward 13 millions in so-called "thick" butter, were shown to bear a definite relation to the brine-leaking tendency of certain kinds of butter, and to certain butter faults. Butter losing brine on standing always contained comparatively few drops and of a larger size than butter that did not lose brine on standing. The water content of the butter did not necessarily determine whether or not brine would separate from the butter on standing; some of the butter with the highest water content in the Permanent Danish Butter Exhibitions did not lose brine, and vice versa.[1]

Specific gravity of butter and serum components.—The following average data were obtained for the specific gravity of butter and the components of the serum (except where otherwise stated the data refer to 15° C., water at 15° C. being=1):

Specific gravity at 15° C.

Salted butter (14 determinations)		0.9625
Fresh unsalted butter:		
"Thick" butter (water 14.80 per cent) 10 determinations		.9480
"Clear" butter (water 13.74 per cent) 9 determinations		.9466
Sweet-cream butter (water 13.08 per cent) 6 determinations		.9458
Butter fat (6 samples)		.9341
(Fleischmann	0.9303)	
(Blyth	.9275)	
Butter fat at 100° C. (water at 15°=1) 5 samples		.8682
Butter fat at 100° C., 53 samples		.8667
(König	0.8650-0.8680)	
(Pfeiffer	.8675)	
(Skelweit	.8672)	
Milk sugar (water free)		1.5673
(Equivalent to 1.524 for $C_{12}H_{22}O_{11} + H_2O$ (Schroeder 1.525, water at 4° C=1.)		
Casein (4 determinations)		1.3424
(Assuming the specific gravity of the ash equals that of milk ash, 3.13, see below.)		
Casein, ash-free		1.3379
Membrane albuminoid of fat globules (3 determinations)		1.3675
Membrane albuminoid of fat globules, ash-free		1.3115
Milk ash (2 determinations, 17½° C.)		3.1305
Butter serum in "thick" butter		1.0310
Butter serum in "clear" butter		1.0290

—F. W. WOLL.

[1] Rpts. Copenhagen Experiment Station, 28, 1893 (E. S. R., 5, p. 722); 33, 1895 (E. S. R., 7, p. 627).

Milk fat and cheese yield, L. L. VAN SLYKE (*New York State Sta. Bul. 110, n. ser., pp. 251–280*).—This bulletin gives an account of a continuation of work previously reported in Bulletin 82 of the station (E. S. R., 7, p. 158). During the season of 1895 samples of the milk of 50 herds of cows delivered at a cheese factory were analyzed to learn the relation existing between milk fat and casein and milk fat and cheese yield, and to learn whether the fat content forms the fairest basis for paying for milk at cheese factories. The summary of results for the season is given as follows:

"When fat in milk increases, the casein and cheese yield also increase in general, though in special cases the casein and cheese yield may increase while the fat remains unchanged, or the fat increase while the casein remains unchanged or even decreases. . . .

"Although casein and cheese yield generally increase when the milk fat increases, the casein more often increases less rapidly in proportion than the fat. The general averages obtained from the season's results as between milk containing 3 and 4 per cent of fat can be indicated as follows:

Fat in milk.	Casein in milk.	Amount of casein for 1 lb. of fat in milk.	Cheese made from 100 lbs. of milk.	Cheese made for 1 lb. of fat in milk.
Per cent.	*Per cent.*	*Pound.*	*Pounds.*	*Pounds.*
3	2.10	0.70	8.55	2.85
4	2.40	.60	10.40	2.60

"The amount of casein for 1 lb. of milk fat decreases about one-tenth of a pound, from 0.70 to 0.60 lb., when the fat in milk increases 1 lb.

"As a rule, when milk fat increases, the amount of cheese made for each pound of milk fat decreases. In milk containing 3 per cent of fat, 2.85 lbs. of cheese are made for each pound of milk fat; while in milk containing 4 per cent of fat, 2.60 lbs. of cheese are made for each pound of fat.

"Cheese made from milk poor in fat is not like, in composition, cheese made from milk rich in fat. The former contains more casein and water in 100 lbs. This increased cheese yield relative to fat, in case of poor milk, due to casein and water, has a market value of only 2 cts. a pound.

"Milk rich in fat can be made to yield cheese of the same composition as milk poorer in fat in one of two ways: (1) By adding skim milk to, or (2) removing fat from, the richer milk. Then the cheese yield for a pound of fat becomes the same.

"The difference in the cheese yield of milk fat in the case of poor milk over richer milk is a skim-milk difference, and the extra yield of cheese for fat from poor milk is the poorest kind of skim-milk cheese.

"Payment for milk according to amount of cheese yield gives unfair advantage to poor mlik, since cheese made from rich milk is worth more, pound for pound, than cheese made from poorer milk.

"Milk should in no case be paid for at cheese factories by weight of milk alone, since different milks differ greatly in their cheese-making powers.

"A critical comparison of all methods of paying for milk, suggested or in use, leads to the conclusion that milk fat affords the fairest practicable basis to use in paying for milk for cheese making."

The restoration of the consistency of pasteurized cream, S. M. BABCOCK and H. L. RUSSELL (*Wisconsin Sta. Bul. 54, pp. 8, figs. 2*).—A simple method for determining the relative viscosity of cream is described. Drops of cream are placed near the edge of a small piece of glass about 12 by 15 in., which is inclined at an angle sufficient to cause the cream to flow down the plate. The glass plate should be of good quality and free from dirt. Several drops of each sample should be used. Cream having the heavier body moves more slowly down the glass, and the length of the several cream paths is taken as a measure of the relative consistency.

The authors found that the viscosity of pasteurized cream could be restored by adding freshly slacked lime in solution. As lime is comparatively insoluble in water, a solution of sugar and water was used as a solvent. The lime solution is prepared as follows:

"Two and one-half parts by weight of a good quality of cane sugar (granulated) are dissolved in 1 part of water; and 1 part of quick lime gradually slaked in 3 parts of water. This milk of lime should be poured through a wire strainer to remove coarse unslaked particles and then added to the sugar solution. The mixture should be agitated at frequent intervals, and after 2 or 3 hours allowed to settle until the clear supernatant fluid can be siphoned off.

"Where large quantities are made, we have found it convenient to mix the ingredients in a revolving barrel churn. The clear liquid (viscogen) should be kept in well-stoppered bottles which are filled full for the reason that it absorbs carbonic acid from the air, thus reducing its strength, and also because, where air has access to the solution, it darkens in color after a time. This latter chemical change, however, does not seem to impair its usefulness.

"The quantity of lime recommended in the above formula is considerably more than will be dissolved by the sugar solution. This excess is added because of the impurities contained in our Wisconsin lime, which is of dolomitic origin, and hence contains nearly as much magnesia as lime. As these impurities are practically insoluble in the sugar solution they have no effect in the prepared viscogen.

"After siphoning off the clear fluid, the residue still contains some of the sugar solution, that remains turbid for a long time. This sugar can be recovered by adding considerable water to the residue and allowing it to settle again, when the clear liquid can be poured off and used in the place of an equal quantity of water in the preparation of the next lot."

This solution of lime in sugar is called "viscogen," and the treated products visco cream, visco-milk, etc. Viscogen is strongly alkaline and should be used with care. Under no circumstances should a sufficient amount be added to cream to render it alkaline. Enough should be added to almost neutralize the acid of the cream. The authors recommend, as a simple method of determining the amount of viscogen required, to add it to a measured sample of the cream, testing with phenolphthalein or other indicator which shows when the neutral point is reached, and from this to calculate the amount of viscogen to be added to the total amount of cream.

"Certainly no objection can be raised from a sanitary standpoint to the amount of sugar added. Lime is a normal constituent of milk, and the amount added to the prepared cream should never exceed 4 parts in 10,000, which is really less than the usual variation in lime content between milks from different sources. Hence, its physiological effect is trivial. Furthermore, lime in solution is commonly prescribed by physicians to be added to the milk designed for infants and invalids, which of course would not be done if it were injurious.

"The laws regarding the sale of milk almost without exception prohibit the addition of any foreign substance to milk sold as pure milk. Under this head the use of viscogen would be an offense and the person using it subject to legal action if it was sold as a natural product. The use of a distinctive qualifying word, as is proposed in this case, viz., visco-cream, visco-milk, etc., places this product in another category similar to the various proprietary lactated foods, of which a great number are on the market."

Fat determination in milk, E. GOTTLIEB (*Nord. Mejeri Tidn., 11 (1896), pp. 603-605*).—Six samples of partially skimmed milk, separator skim milk, and mixtures of the two were analyzed in 10 different Danish and Swedish laboratories by the Röse-Gottlieb method of fat determination,[1] and in two cases also by the Adams and the kaolin extraction method. The following table gives the results obtained by the different analysts:

Fat determinations in samples of milk.

	Sample 1 (partially skimmed).	Sample 2.	Sample 3.	Sample 4.	Sample 5.	Sample 6 (separator skim milk).
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Röse-Gottlieb method	2.11	1.91	1.46	0.52	0.23	0.12
Do	2.10	1.91	1.46	.53	.23	.13
Do	2.06	1.87	1.42	.52	.21	.12
Do	2.08	1.88	1.43	.52	.22	.12
Do	2.08	1.88	1.43	.52	.22	.13
Do	2.13	1.91	1.53	.53	.25	.14
Do	2.14	1.92	1.42	.55	.18	.11
Do	2.06	1.89	1.41	.50	.22	.09
Do	2.09	1.91	1.44	.52	.22	.13
Do	2.09	1.89	1.43	.51	.22	.12
Average	2.09	1.90	1.44	.52	.22	.12
Kaolin method	2.06	1.87	1.41	.43	.18	.09
Do	2.07	1.87	1.40	.47	.19	.09
Adams method	2.09	1.89	1.42	.49	.18	.10

—F. W. WOLL.

Ropiness in milk, C. E. MARSHALL (*Michigan Sta. Bul. 140, pp. 97-108, figs. 4*).—The author isolated a microörganism causing ropiness in milk. A technical description of this microörganism is given. Two epidemics of ropy milk in dairy herds were investigated. In the author's opinion the infection came through the cows and the bacteria were adherent to the udder. He recommends as a means of prevention and cure of this trouble that the milk utensils be kept clean and sterilized after every milking, and that the stables, the udders of the cows, and the hands of the milkers be thoroughly cleansed and disinfected.

Notes on dairy bacteriology, L. H. PAMMEL and I. J. MEAD (*Iowa Sta. Bul. 34, pp. 687-691*).—The authors made a bacteriological study of 15 samples of milk possessing peculiar odors. The microörganisms were isolated and are described.

"It is interesting to note that the pure cultures produced the same odors in milk observed in the original, so that this simple bacteriological test will serve to locate

[1] Landw. Vers. Stat., 40 (1890), p. 1.

any troubles that may arise in the creameries. It also shows that weeds are not responsible for all of these off odors and tastes.

"Patrons should exercise the greatest care in keeping their premises clean, especially the stable, barnyard, and dairy utensils."

Swedish butter exhibitions, 1896, N. ENGSTRÖM (*Tidskr. Landtmän, 17 (1896), pp. 910–919; Nord. Mejeri Tidn., 11 (1896), pp. 591–593*).—The report shows that 301 creameries took part in the periodical Swedish butter exhibitions during 1896, 164 exhibiting at Malmö and 137 at Gothenburg. Ten exhibitions were held at each place. The total number of tubs of butter judged was 1,158. The average score of the butter exhibited was 11.35 points (perfect score, 14 points). The scores for the different classes of creameries exhibiting were as follows:

Butter scores.

Class of creamery.	Number of samples.	Proportion scoring between 12 and 13.9 points.	Average score
		Per cent.	
Coöperative	404	51.2	11.4
Estate creameries	348	44.8	11.3
Estate-proprietary	210	50.5	11.4
Proprietary	196	43.9	11.2

The average water content of the butter (1,158 samples) was 13.54 per cent, the maximum per cent of water found in any sample of butter being 20.2 per cent and the minimum 10.4 per cent. Forty-four tubs of butter (3.8 per cent of the total number of tubs) from 31 creameries (10.3 per cent of the total number of creameries) leaked brine on standing.—F. W. WOLL.

A modification of the Babcock method, J. M. BARTLETT (*Maine Sta. Bul. 31, pp. 8, figs. 2*).—The author describes a modification of the Babcock method of milk testing and reports a number of comparative tests employing the modification.

"The modifications, briefly stated, are as follows: The modification of the method consists chiefly in filling the bottles with hot water after the milk or cream and acid are added, before they are put in the centrifugal machine and whirled. In this way the separation is completed with one whirling and the time required for the second whirling is saved.

"The modifications of the apparatus are: The base portions of the milk and cream bottles are graduated so that no acid measure is required and the base portion of the cream bottle is reduced in size."

Coöperative dairying in Ireland, H. PLUNKETT (*Jour. Roy. Agl. Soc. England, 3. ser., 8 (1897), II, No. 30, pp. 340–343*).—This article is quoted from a paper on "Agricultural coöperation" in *Trans. Surveyors' Institution, 19 (1897), No. 8*.

The dairying and poultry industries in Normandy (*Jour. Roy. Agl. Soc. England, 3. ser., 8 (1897), II, No. 30, pp. 344–354*).—This is quoted from the report of the British consul at Cherbourg, France. Foreign Office Annual Series, 1897 [c. 8277].

Concerning unadulterated and whole milk of abnormal composition, and the importance of taking samples of milk at the stable, H. WELLER (*Forsch. Ber. Lebensmtl., 4 (1897), No. 6, pp. 155, 156*).

Notes on the solidifying point of milk, J. WINTER (*Bul. Soc. Chim. Paris, 17–18 (1897), No. 11, pp. 570–572*).

A remedy for the circulation of infecticus milk (*Dietet. and Hyg. Gaz., 13 (1897), No. 7, pp. 440–442*).—In an article quoted from the American Medical and Surgical Bulletin, the need of the thorough inspection of cows, stables, milk, etc., is urged. The confiscation of condemned milk is recommended, with compensation to the dairymen.

Microörganisms in dairying, N. BENDIXEN (*Die Microorganismen in Molkereibetriebe. Berlin: Paul Parey, 1897, pp. 45, figs. 19: noted in Ztschr. Nahr. Untersuch. u. Hyg., 11 (1897), No. 10, p. 157*).

Bacteriological investigations of kefir, E. VON FREUDENREICH (*Centr. Bl. Bakt. u. Par., 2. Abt., 3 (1897), Nos. 4–5, pp. 87–95; 6, pp. 135–141, figs. 2*).

A flavor-producing micrococcus of butter, S. C. KEITH (*Tech. Quart., 10 (1897), No. 2, pp. 247–249*).

The skimming of milk, J. BRUHAT (*Jour. Hyg., 22 (1897), Nos. 1083, pp. 295–298; 1084, pp. 307–310*).—A discussion of the subject from a hygienic and legal standpoint.

Outline of dairy bacteriology, H. L. RUSSELL (*Madison, Wisconsin: Published by the author, 1896, pp. 192, figs. 25*).—This is a second and revised edition of this textbook.

A note on some of the requirements for a sanitary milk supply, W. SEDGEWICK (*Tech. Quart., 10 (1897), No. 2, pp. 245, 246*).

VETERINARY SCIENCE AND PRACTICE.

Bovine tuberculosis, M. A. REYNOLDS (*Minnesota Sta. Bul. 51, pp. 343–417, figs. 10*).—A popular discussion of this subject, with a report of work done. A few remarks are made on the history of the tuberculin test, showing that it is coming into general use. Arguments that have been used against it are briefly mentioned and refuted, and it is shown that where there is a possibility of danger there is danger, that an apparently sound udder does not guarantee nontuberculous milk, and that the cooking of meat is not always to be trusted for killing the germs, since meat may be roasted or broiled and thoroughly cooked on the outside and still remain infectious within.

The text of the general laws of Minnesota relative to tuberculosis is given in full, as well as the decisions of the supreme court of the State regarding them. In effect they prohibit the sale of uninspected milk in cities or villages without a license. By the court a city ordinance requiring the inspection of milk, though from a herd without the city limits, is held to be not extraterritorial, and that the tuberculin test is not unreasonable.

The subject of the control of bovine tuberculosis in Switzerland, Denmark, and France is briefly discussed, and the methods of procedure at the Minnesota station described in detail.

The method of making the injections and the diagnosis, as well as the tuberculin itself, is described. The effect of the injection on tuberculous cows is discussed, and tables given showing the details of the work. No appreciable injurious effect upon the health of the animal is shown, nor is there any upon the weekly gain of fattening steers. A tuberculous steer during the first of the 5 weeks devoted to the test showed the greatest gain of any in the tested lot. Previously it had been unthrifty and irregular in its weekly gains.

In connection with this subject the resolutions of the United States Veterinary Medical Association in 1895 relative to tuberculosis and the tuberculin test are quoted, after which the author proceeds with the subject in connection with Minnesota cattle. The following table, in which the results of 3,430 tests are summarized, shows that the disease prevails most among the pure breeds, city dairies, in cases of poor stable conditions, and of poor ventilation; and, further, that good stables and ventilation do not necessarily prevent infection.

Prevalence of tuberculosis according to class and condition.

Class.	Number of herds tested.	Number of animals tested.	Number of reactions.	Per cent tuberculous.
1. Natives	137	2,839	223	7.8
2. High grades	5	157	17	10.8
3. Pure breds	6	258	43	16.6
4. City dairy herds	108	2,736	284	10.4
5. Farm herds	38	6,694	99	14.2(7.8)[1]
6. In "good" general condition of stables	57	1,370	139	10.1(6.8)[1]
7. In "fair" condition of stables	59	1,140	83	7.28
8. In "poor" condition of stables	32	864	165	19.1
9. With "good" ventilation	45	1,011	99	9.8(5)[1]
10. With "fair" ventilation	45	1,087	67	6.16
11. With "poor" ventilation	48	1,210	201	16.6

[1] Fifty-five of these tuberculous animals in each case (groups 5, 6, and 9) were from the same 2 herds. Eliminating these 2 herds from groups 5, 6, and 9 the percentages are reduced, respectively, to 7.8, 6.8, and 5.

The 11.1 per cent of the 3,430 animals here shown to be tuberculous must not, we are told, be understood to represent the cattle of the State, for few farm herds have been tested as compared with breeding herds and city dairies. These have been shown by general experience to be more subject to attack than farm herds or native stock subject to only ordinary conditions. But such results must not be taken, it is added, as an argument against founding herds of pure breeds, though it may be taken against founding a herd on tuberculous stock.

Another table gives the results of the examination of some 27 herds numbering 772 head of cattle, of which 15.5 per cent were found tuberculous and 70 of the 71 of which *post-mortem* examinations were made proved so. Another table locates the disease as shown by the post-mortems. A large percentage of the animals shows disease of the lungs and neighboring glands and pleura, indicating the air as the common source of infection.

Further, there are discussed experiments with tuberculin to determine the accuracy of the test, the circumstances under which animals may fail to react, whether it is injurious to sound or to tuberculous cattle, whether a cure or merely an immunity from tuberculin has been effected when no reaction occurs after one or more injections, the diagnostic value of the retests as compared with the first, the possibility of an accurate estimate being made as to the extent or the location of the disease from evidence furnished by the test, whether the test is reliable in cases of advanced pregnancy, and whether tuberculin has any therapeutic value in bovine tuberculosis.

Summarizing the results, the author states his belief that the test is both accurate and practical, neither injurious to the health of sound nor of tuberculous cattle, given in doses of 1 cc. for each 500 or 250 lbs. live weight; that where failure to react occurs after several injections a cure may have been effected or the animals may simply have become insusceptible to the agent and still remain infectious; that an animal may remain tuberculous and still fail to react, and hence that retests are of much less value; that about 70 per cent of the animals showing a distinct rise of temperature of 3.5° or more within 10 hours were found to have the lungs and attached glands badly affected, and that if the disease was extensive or evidently of long standing, low or even no reactions might be given; that the test may be uncertain but not otherwise objectionable in cases of advanced pregnancy; and finally that tuberculin may have a curative effect when infection has been recent or is of limited extent, and that it may aid a tendency to recover in other cases.

The author is of the opinion that the tuberculin test should be made a condition of the granting of licenses to sell and should be made twice a year. Inspection should be thorough. The laws of hygiene should be observed in the manner of keeping cows, etc. All bulls that react at once, all heifers under 2 years of age, all cows over 10, and all others giving evidence of being badly infected should be killed. Only tested bulls should be used, and calves from tuberculous mothers should be reared upon milk from nontuberculous cows or upon sterilized milk.

In a breeding experiment it was found that of 27 calves from tuberculous mothers 23 remained healthy after one or more tests, 3 became tuberculous, and that one, evidently tuberculous, died soon after birth. The results of similar experiments, all tending to the same conclusions, are quoted.

Relative to the subject of tuberculous attendants for cattle, the author thinks the danger from this source considerably overestimated.

Serum injections as a preventive against lung diseases in horses, C. O. JENSEN (*38te Ber. K. Vet. Landbohöjskoles Lab. Landökon. Forsög, 1897, pp. 1–36*).—The author gives a number of experiments with a serum-injection method for the prevention of lung diseases in horses, conducted by him or under his direction, and reviews critically foreign experiments in this line. The method adopted is as follows: Horses that were strongly attacked and have been free from fever for 6 to 12 weeks are selected for bleeding. The horse is shaved and washed with soap and an antiseptic fluid (lysol, water, etc.) at the place where the injection is to be made. All instruments, vessels, etc., used are previously sterilized. The blood is gathered directly in gallon glass jars closed with a layer of boiled parchment paper. As soon as the blood is coagulated it is placed in a cool place or in ice water, taking care to guard against dust. After 24 to 48 hours the clear liquid separated out is measured into sterilized flasks by means of a pipette, and if it is to be kept for some days a few drops of chloroform are added. Injections are made at the lower part of the chest or on the side of the neck. The liquid is distributed in the subcutaneous tissue by gentle pressure. Every trace of swelling generally disappears in about an hour and the horse may do ordinary work the following or within the same day. The conclusions arrived at by the author are that the method furnishes a valuable means for producing immunity from the disease for a time and for stopping enzoötic lung fever. The injections do not, however, always prevent the appearance of the disease when the animal is already infected. We are not able at the present time to give an accurate explanation of the action of serum injections in different diseases, but, as regards the lung diseases, we can safely say that the injections only increase or assist the natural power of resistance, and it is therefore also probable that the effect may be abrogated when the causal conditions of the disease appear especially strong in individual cases.

Properly conducted, the method is harmless. Nearly 1,000 injections were made in Denmark and in no case was there an appearance of phlegm, fever, or similar effects.—F. W. WOLL.

Texas fever, J. W. CONAWAY (*Missouri Sta. Bul. 37, pp. 81–139, figs. 11*).—During the year coöperative experiments were carried on at the Missouri station grounds in coöperation with the State Board of Agriculture and the Texas Experiment Station. The results are considered in this bulletin under 4 heads:

(1) *Confirmation of the tick theory as to the transmission of Texas fever.*—Ticks were obtained from Texas; microscopical examinations of the blood of animals were made; native cattle were exposed in the presence of southern native cattle; native cattle were exposed to southern cattle from which the ticks had been removed; the pasture was infested with ticks taken from southern cattle; young ticks hatched artificially from eggs laid by adult ticks picked from southern cattle were placed on native cattle; experiments were made to show that the disease is not transmissible by the excretions of southern cattle, and all with the result of confirming the discovery of F. L. Kilborne, namely, that infection is caused by these ticks. The method of rearing the ticks in an improvised brood chamber formed by a Mason jar containing moist earth and grass and several autopsies are described.

(2) *Experiments on the prevention of Texas fever.*—The method of dipping, in which the cattle are driven into a large vat filled with water covered with oil, is described. Several different parasiticides were employed, but that which gave the most favorable results was cotton-seed oil. Some trouble was experienced with mixtures contain-

ing carbolic acid. Native cattle were afterwards exposed to the dipped cattle, but no evidence was later found of their being infected by ticks. Temperature readings of the various animals, which were taken daily, are presented in detail in tabular form. The autopsy of a cow used in the experiment, but which died from an abscess in the base of the udder, is described, and also the case of an outbreak at Hannibal, Missouri, where some of the cattle were evidently prevented by dipping from contracting the fever.

Experiments were also made with serum to determine whether immunity from the fever might not be established. A method of preparation and injection of the serum is described and the conclusion finally drawn that while the evidence obtained from the experiments gives grounds for believing that prevention may be secured in many cases, the author does not feel quite justified in making a positive statement in favor of the serum. The temperature record of the injected cow is given in tabular form.

(3) *Disinfection of pastures.*—Experiments were made with adult ticks to learn what their movements might be when removed from the animal, and all tend to confirm the idea that infection may be confined within very narrow limits and that it will not be difficult to disinfect large areas, if systematic efforts are made for that purpose. In the experiments the ticks were placed on a flat surface covered by a heavy paper 3 or 4 ft. in size, blackened by soot upon which the tracks made by the animal were readily preserved by passing the paper through a solution of shellac.

These experiments all tend to show that under ordinary conditions the tick seldom gets more than a very few inches from the point where it is dropped. The author goes on to state that pastures may be disinfected by burning the grass at the first opportunity after it is killed by frost. The combustibility of the grass may be increased by spraying a mixture of crude kerosene and 5 per cent of naphtha or 10 per cent of gasoline over it. Further he speaks favorably of quarantining infested grounds, pointing out the fact that if horses and cows are kept off the infested pasture the tick will finally die, since the presence of these animals is necessary to its existence.

(4) *Experiments on the Australian cattle disease.*—Ticks were received from Australia via the Texas Experiment Station, but it is stated that their condition upon arrival was such as not to be favorable to results that would yield evidence either for or against the conclusion that the Australian cattle disease and Texas fever are identical, but evidence from other sources leads the author to think the 2 diseases the same.

Parasitic gastro-enteritis in lambs, J. McFADYEAN (*Jour. Roy. Agl. Soc. England, 3. ser., 8 (1897), I, No. 29, pp. 38–56*).—The author gives the result of the examination of some 40 lambs that had died of this disease. In all cases some nematode worm was found in the intestine, and in a large portion of cases 2 or more species were found in association. Those most frequently noted were *Strongylus filaria*, *Trichocephalus affinis*, and *Strongylus contortus*, but he is not inclined to attach much importance to these 3 species. The real cause of the trouble he attributes to a small nematode that he describes as a new species under the name of *Strongylus cervicornis*, which was found in the fourth stomach. To this worm he attributes the disease that carried off a large number of lambs in Lincolnshire, Leicestershire, and other counties in 1895 and previously.

In this species the males as usual are less numerous and smaller than the females, the former being 0.3 in. and the latter about 0.4 in. in length. The largest females that he met with were 0.5 in. long. In most respects the worm resembles *Strongylus contortus*, but is to be distinguished from that form by differences in the shape of the caudal extremity and by the further fact that it is a slightly larger worm.

Under the head of treatment, experiments with carbolic acid, lysol, turpentine, Fowler's solution, and corrosive sublimate are recorded and the surprising results obtained that the confidence which has generally been placed in them as parasiticides is an entirely mistaken one, for none of them proved to be effective unless used in such strengths as would be fatal to the host. Two and one-half per cent of turpentine in milk had no serious effect on worms left in it for over 12 hours; neither did a 5 per cent solution upon worms left in it for 2 hours. Worms left for over 12 hours in Fowler's solution diluted with 40 times its bulk of water were found to be still active.

The best of the vermicides seems to be lysol, since a 10-minute exposure to a 1 per cent solution of this substance in water proved fatal and since half a pint of such a solution may be given with safety to a six months' old lamb. The inefficacy of the usual remedies is attributed to the density of the cuticle of the adult worms; and, reasoning from this, the author thinks they might be used with success in destroying the eggs or young worms. At least they might still be employed as preventives against infection or to check the multiplication of the worms already within the alimentary tract of an animal.

Water is regarded as the vehicle by which the worms gain entrance, and this the author emphasizes by advising that lambs be kept off land which has been flooded and that they be not allowed access to stagnant ponds or ditches.

Parasites of the lungs of sheep, G. T. BROWN (*Jour. Roy. Agl. Soc. England, 3. ser., 8 (1897), I, No. 29, pp. 20–38, figs. 12*).—The 3 nematodes, *Strongylus filaria*, *S. rufescens*, and *Pseudalius ovis*, are discussed. After a few general remarks relative to the time of the discovery of the first of these worms, the author briefly reviews the results of Cobbold's experiments, and then proceeds to discuss investigations of his own begun in 1888 and continued down to the present time. In these the conclusions of Leuckhart relative to the ability of *S. filaria* to withstand drying were confirmed, and it was further shown that the worms are capable of withstanding freezing. Earthworms were kept in earth for some months and when finally examined embryos of the nematode were found that were considerably in advance of those that had been kept in moist earth. Sheep were introduced into infested pastures and from time to time killed and examined.

Summarizing the results of his experiments the author concludes relative to *S. filaria* as follows:

"It appears that eggs containing living embryos and embryos which have got free from the eggs are expelled from the bronchial tubes of infested sheep in enormous numbers. It is also established that the adult worms have only a temporary residence in the lungs, but whether they are expelled living or dead has not been ascertained with certainty; nor is it known what becomes of them when they quit the lung tubes. The embryos, it has been proved, live for months in wet earth; they may be dried by the heat of the sun without being destroyed; nor does the frost seem to do them any serious damage. In common with the other larval forms of strongyles, they are swallowed by earthworms and again ejected after having gone through certain changes; but, with the evidence obtained from the examination of many hundreds of earthworms, it is impossible to believe that even a considerable proportion of the embryos which are expelled from the sheep's lungs are disposed of in this way. It is not unlikely, however, that a large number become parasitic to certain plants and in that position acquire a sufficient development to fit them for residence in a warm-blooded animal. Here again, however, the evidence is utterly insufficient."

The red thread worm, *Strongylus rufescens*, and the hair worm, *Pseudalius ovis*, are critically discussed and support given to Koch's conclusion that these two worms have often been confounded. According to this view, Pseudalius represents the first stage in the life cycle of *S. rufescens.* But the author's observations do not coincide in certain details with those of Koch, and he would regard "Pseudalius as the last stage of *S. rufescens* rather than the first; in short, that having finished its life work and done as much damage to the lung structures as the circumstances of its organization permit, it finally retires into an isolated position in various parts of the lungs, especially on the surface, coils itself up, and at length becomes a mere calcareous mass."

The effect of the presence of the worms in the lungs is passed over briefly, and then the subject of treatment discussed. Overcrowding and the continued repasturing of sheep on the same ground, exposure, and insufficient feeding are to be avoided as unquestionable causes. It is shown that the services of the veterinary are seldom called in until the worms have taken up a position from which they can not be dislodged by the ordinary remedies.

Louping ill, P. WILLIAMS (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 9 (1896), pp. 278–290, figs. 10*).—The author reports upon his researches into the causation and prevention of louping ill or trembling in sheep (*Ixodic toxaemia*). Sheep were muzzled and pastured with others in pastures infected with ticks; pastures were sown with salt, which killed the old grasses; inoculation experiments were made with cultures made from diseased animals—all with the general result of confirming the author in his previous conclusions, namely, that there is no louping ill where there are no ticks; that ticks are active but for a brief period during the summer and coëxistent with louping ill; that the bacillus may develop upon the old grasses, but must pass through the body of the mite before it acquires its pathogenic property; and further, that the proper methods of procedure for the extirpation of the disease are (1) the burning of all old and rough grasses harboring ticks or pasturing them down with cattle; (2) that the application of common salt or lime or a combination of these or some cheap phosphatic manure, such as basic slag, should be applied to the land; (3) that whenever the weather permits the sheep should be dipped in some carbolic preparation; that where this is not possible, they should be pastured on clean land during the tick season; and finally, that lambs should be removed from their dams when the latter show signs of the disease, since cultures from ewes' milk has revealed the organism in various stages.

Prophylaxis of bovine tuberculosis, E. NOCARD (*Rapports Préliminaires 3e Congrès Internat. d'Agr., Bruxelles, 1895, pp. 131–136*).—French, Prussian, Saxon, and other data are noted showing the percentage of prevalence of tuberculosis, and the modern methods of tuberculin tests, isolation, etc., recommended. In 1893 in Prussia 8.9 per cent were affected; at Berlin, 15.1; Magdebourg, 17.5; Copenhagen, 17.7; Milan, more than 10; at Amsterdam and Moscow it approached 5.5; at Toulouse in 1889 more than 10; in 1891 in Great Britain, 12.5. In some instances the governmental measures taken, as at Bucharest, greatly reduced the disease.

On sterile tuberculosis and subcutaneous (tuberculosis) ulceration, H. MARSH (*Lancet, London, 1 (1897), No. 3845, pp. 1262–1264*).

Contagious pleuro-pneumonia in Belgium, L. STUBBS (*Rapports Préliminaires 3e Congrès Internat. d'Agr., Bruxelles, 1895, pp. 693–702*).—The conclusions are as follows: (1) Contaminated or suspected animals should be isolated as soon as condemned and should have no other destination than the slaughterhouse; (2) it is preferable to condemn immediately or to drive toward the slaughterhouse, observing prescribed regulations; (3) the indemnity accorded in case of condemnation should be equal to the total value of the animal, and the carcass should become the property of the State; and (4) an inspection of meats should be instituted.

General report of the sanitary control of domestic animals during 1895 (*Bul. Agr. [Bruxelles], 12 (1896), pp. 368–459*).—As a whole the condition of domestic animals is said to be satisfactory. There is noted a decrease in the number of animals affected with glanders and pleuro-pneumonia as compared with past years.

Prevalent pleurisy due to the bacillus of Friedländer (*La Semaine Méd., 1897, p. 68; abs. in Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897), No. 17–18, p. 690*).

Diagnosis of typhus cultures by means of dried typhus serum, M. W. RICHARDSON (*Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897), No. 11–12, pp. 445, 446*).—Serum obtained from the heart of a person that has died of typhus is dried on filter paper. A piece ½ cm. square is placed in ½ cc. of a clear broth culture of typhus bacillus 24 hours old. After 5 minutes a microscopical examination shows the typical reaction—loss of movement and agglutination of the bacilli. Tried with *Bacillus pyogenes fætidus*, the colon bacillus, and typhus of the mouse, no reaction is obtained.

Prophylaxis of glanders, E. NOCARD (*Rapports Préliminaires 3e Congrès Internat. d'Agr., Bruxelles, 1895, pp. 494–496*).—Sanitary measures recommended, including mallein tests, and isolation.

Researches on the value of mallein in the diagnosis of glanders, E. DECLOUX (*Bul. Dir. Agr. Com. Tunis, 2 (1897), No. 3, pp. 85–100*).

The cattle malaria in the Campagna of Rome, A. CELLI and F. S. SANTORI (*Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897, No. 15–16, pp. 561–572, pl. 1)*).—A report of microscopical and other studies of Texas fever. Hæmaglobinuria and Hæmaturia are not thought to be names sufficiently characteristic of the disease. A comparison is made between this disease and human malaria and the two found to have many points in common, hence the author's term cattle malaria.

Contribution to serum diagnosis in Typhus abdominalis, UHLENHUTH (*Deut. militarartz. Ztschr., 1897, No. 3; abs. in Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897), No. 17–18, pp. 698, 699*).

On the differential staining of bacilli of tuberculosis and bacilli of Smegma, HONSELL (*Arbt. pathol. anat. Inst. Tübingen, 2 (1896), p. 317; abs. in Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897), No. 17–18, p. 700*).—Carbol fuchsin staining as usual, washing and drying, placing in alcohol acidulated with 3 per cent of hydrochloric acid for 10 minutes. Washing and after staining with alcoholic methylenblue diluted to one-half with water. This method is applicable to the most resistant forms of Smegma's bacillus.

Infantile bronchopneumonia due to the bacillus of Pfeiffer (*La Semaine Méd., 1897, p. 38; abs. in Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897), No 17–18, p. 689*).

Sugar beets prevent hog cholera, R. M. ALLEN (*Amer. Agr. (middle ed.), 59 (1897), No. 17, pp. 513*).—The author does not favor quarantine measures, but thinks medical remedies and the method of inoculation do some good. He states that he has not had a case of cholera since he began feeding beets, although formerly he dreaded its appearance every year.

On hog cholera, J. WETTERVIK (*Nord. Mejeri Tidn., 11 (1896), pp. 519, 520, 532, 533, 546–548, 558, 559, 570, 571, 583, 584, 595, 596, 607, 608, 619*).

Simondsia paradoxa in the stomach of wild boars, V. COLUCCI and L. ARNONE (*Mem. Roy. Accad. Sci. Ist. Bologna, 5. ser., 6 (1897); abs. in Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897), p. 215*).—Numerous worms of this species were found in 3 wild boars. The authors think that Cobbold confused the male of *Spiroptera strongilina* with the male of this form. The histology of the worms is described.

The process of inoculation for poisoning by castor oil, C. CORNEVIN (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 15, pp. 835, 836*).—Experiments were performed in which rabbits were fed with seeds of the castor-oil bean or with the meal of the same and gradually indurated so that they were able to withstand poisonous doses, or such as killed animals not so previously treated.

A new diphtheria antitoxin (*Nature, 55 (1897), No. 1434, pp. 597, 598*).—This makes note of a communication from Dr. Smirnow in Archives des Sciences Biologique. Virulent diphtheria broth cultures by this method of preparation are electrolyzed and an antitoxin of great efficacy obtained.

On the physiological and pathological action of the X-rays, SOREL (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 15, pp. 826–828*).—The rays were directed against the epigastric region of the body of a six-year-old girl. Six days later a red spot with a white center appeared at the place upon which the rays had impinged. The spot caused considerable pain, and even agony, and continued for some time, giving rise to a suppuration that lasted a month. The author concludes that the rays should not be allowed to act long at a time on some subjects, especially on the more important organs.

Contribution to the phylogeny of the parasitic Plathelminthes, E. LÖNNBERG (*Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897), No. 17–18, pp. 674–684*).

A new tapeworm of the cat, E. VON RATZ (*Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897), No. 11–12, pp. 465–473, figs. 3*).—A description of *Dipylidium pasqualei*.

Concerning the curative power of antipneumonic serums obtained from different immunized animals, N. PANE (*Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897), No. 17–18, pp. 664–674*).—Experiments were made with serums obtained from the cow, ass, and dog. The final conclusion arrived at is that the antipneumonic serum displays no immediately direct action against the pneumococcus, but that the injected serum produces in the body a condition of active immunity that depends upon the virulence of the serum. The author points out that many facts incline him to Metschnikoff's phagocyte theory. The leucocytes are supposed to emit a substance protecting against pneumococcus only.

Studies on Tetrarhynchus, with notes on other tapeworms, II, T. PINTNER (*Sitzungsber. k. Acad. Wissensch. Wien, 1. Abt., 105 (1896); abs. in Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897), No. 17-18, pp. 697, 698*).—The work describes a Tetrarhynchus from the stomach of Heptanchus, and contains notes on the excretory systems of different Cestodes. In the larva of the Tetrarhynchus was found a hitherto unknown system of canals, the significance of which does not at present appear. Over the excretory vessels was seen a thin-walled canal running anteroposteriorly describing anteriorly a large bend toward the receptacular wall. It is not coiled. Many small blind branches arise from it. In the scolex the wall cells of the canal become arranged into an epithelium. The main canal here also separates into two branches.

On the simultaneous occurrence of angina and perityphlitis (*Therap. Monatschft., 1897; abs. in Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897), No. 17-18, p. 689*).—Cases are noted in which *Angina fallicularis* was found in connection with perityphlitis to which it had evidently allowed an entrance.

On the use of dried blood dissolved in water for the serum diagnosis of typhus, W. JOHNSTON (*Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897), No. 13-14, pp. 523-526*).

Bacteriological blood investigations with especial reference to pneumonia, KOHN (*Deut. med. Wochenschr., 1897, No. 9; abs. in Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897), No. 17-18, pp. 687, 688*).

Experimental studies on the general disinfection of the body with actol, E. MARX (*Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897), No. 15-16, pp. 573-578*).—It is concluded that actol is a good antiseptic, but it does not reach the ideal set by Credé for a disinfectant for the whole body, although it is worthy of general use.

Contribution to the knowledge of the bacillus of the plague, R. ABEL (*Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897), No. 13-14, pp. 497-517*).—The morphology and the cultural relations of the bacillus, the effect of sunlight, etc., are described; means of disinfection noted; and the mode of distribution and prophylaxis of the bacillus discussed.

On an entozoic neo-formation, V. DIAMARE (*Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897), No. 11-12, pp. 459-465, figs. 4*).—A description of cyst-like knotty formations in the organs of *Thalassochelys caretta*. Section of the structures showed the presence of a small distomid, *Messogonimus constrictus*.

Organization of service of the sanitary-veterinary police in Belgium, L. STUBBE (*Rapports Préliminaires 3e Congrès Internat. d'Agr., Bruxelles, 1895, pp. 671-692*).—Discusses legislation relative to epizoötic diseases previous to the law of 1882 and subsequent measures. The author's conclusions are as follows: (1) Maintain as many sanitary agents as possible to act promptly; (2) the service of each province should be under the control of the veterinary inspector appointed and paid by the Government; (3) the control of the entire service should be in the hands of an inspector-general appointed by the control administration in agriculture; and (4) a general inspection of meats should be instituted in each district.

International sanitary convention, A. DEGIVE (*Rapports Préliminaires 3e Congrès Internat. d'Agr., Bruxelles, 1895, pp. 577-585*).—Conclusions: (1) A federation of as many countries as possible is needed; (2) also the formation of an international sanitary commission to determine what diseases shall be subject to sanitary police control, and the minimum of measures to be adopted; (3) the diseases that are to be repressed by State action are pleuro-pneumonia, charbon bacteridia, rabies, glanders, pneumo-enteritis of swine, tuberculosis, etc.; (4) the convention shall fix the meaning of the terms "suspected," "infected," and "contaminated," the sanitary zone or circle, and the time during which a place shall be suspected after the disappearance of a disease; (5) each country to be admitted to the union shall have an organized veterinary service; (6) when a disease is noted in one country notice shall be given to the others in a form specified by the convention; (7) each country shall publish an official bulletin noting the localities, etc., infected; (8) a sanitary veterinary control shall be exercised by official agents at ports of entry; (9) animals and animal products, etc., entering or crossing a country shall be accompanied by certificates of origin; (10) international official relations shall be established between veterinarians of bordering countries; (11) interdiction of entry shall be permitted only (*a*) when certain epizoötic diseases reign on the frontier or the interior of a neighboring country, and (*b*) when the sanitary measures of that country are inefficient or badly applied; (12) in order to admit of free movement between bordering countries animals shall be in conditions analogous to those required for importation. These conditions shall be the subject of special agreement between the confederate governments.

A new septicemia of cattle with consecutive nephritis and urocytis, THOMPSON (*Ann. Inst. Pasteur, 11 (1897), No. 6, pp. 523–540*).

Etiology and pathogeny of yellow fever, SANARELLI (*Ann. Inst. Pasteur, 11 (1897), No. 6, pp. 433–514, pls. 9*).—A résumé of what is known and a description of experimental studies, etc., are given.

Experimental and anatomical studies on yellow fever, W. HAVELBURG (*Ann. Inst. Pasteur, 11 (1897), No. 6, pp. 515–522*).—An extract from a memoir bearing this title.

Contribution to the history of Trichinosis, J. C. HUBER (*Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897), No. 17–18, pp. 604–606*.—Cites Pagenstecher, who mentions having found trichinæ in the walls of the small intestines and in the mesentery, and Chatin as having found them in the skins of sausages imported from America.

The morvo-farcinous affection of the solipedes in Belgium, H. DE ROO (*Rapports Préliminaires 3e Congrès Internat. d'Agr., Bruxelles, 1895, pp. 339–346*).—The diagnosis of the disease, police sanitary regulations, mode of indemnification, etc., are discussed. A table gives the number of animals suspected and of those attacked by glanders and their value and indemnification from 1870 to 1894.

Leptothrix placoides, A. R. V. DOBRIGYNISKI (*Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897), No. 6–7, pp. 225–229, figs. 4; abs. in Jour. Roy. Micros. Soc.* [*London*], *1897, No. 3, p. 238*).—Isolated from an old tooth stuffing.

Manual of veterinary microbiology, MOSSELMAN and LIÉNAUX (*Translated from French by R. R. Dinwiddie. New York: William R. Jenkins, 1895, pp. 342, figs. 19*).—This forms a brief introductory treatise. It is concisely written and discusses in part 1 microbes in general, their organization, chemical composition, occurrence, and distribution in nature, and their physiology. In part 2 pathogenic microbes are discussed, and in part 3 the microbic diseases are considered individually.

Concerning the practical applicability of the mouse bacillus, especially of Loeffler's Bacterium typhi murium, M. N. C. L. ZUPNIK (*Centr. Bl. Bakt. u. Par., 1. Abt., 21 (1897), No. 11–12, pp. 446–459*).

Helminthological studies, M. STOSSICH (*Bul. Soc. Adriat. sci. nat., 17 (1896), pp. 122–136, pls. 2; abs. in Zool. Centr. Bl., 4 (1897), No. 12, p. 412*).—The author points out a large number of new hosts for known species of nematodes. A new species, *Strongylus ersiliæ*, from the intestine of *Python molurus* is described.

Protest against proposed legislation restricting the experiments of the Department of Agriculture, J. WILSON (*U. S. Dept. Agr., Circular, Office of the Secretary, pp. 8*).—In this publication the Secretary of Agriculture protests against the passage of the antivivisection bill and explains that it would materially retard the work of several branches of this Department and consequently would be a detriment to the agricultural interests of the country. In the Secretary's opinion the existing law in the District of Columbia has not been shown to be inefficient.

Vivisection in the District of Columbia, C. W. DABNEY, Jr. (*U. S. Dept. Agr., Circular, Office of the Secretary, pp. 8*).—The author discusses the antivivisection bill now before Congress, and points out among other things that its passage would be a hindrance to the work of the Department of Agriculture.

TECHNOLOGY.

The fuel value of corn, T. L. LYON (*Nebraska Sta. Press Bul. 8, pp. 2*).—"The present abundance of corn and its low price has occasioned much speculation as to its fuel value."

In a preliminary test at the University of Nebraska "a good grade of yellow dent corn on the ear of this year's crop and not thoroughly dried" was compared with screened Rock Springs nut coal for heating a boiler used to supply power at the university. In this test 1 lb. of coal evaporated 1.9 times as much water as 1 lb. of corn, a result confirmed by calorimeter tests.

"The coal used cost at Lincoln $6.65 per ton. With coal selling at this price, and worth 1.9 times as much for fuel as an equal weight of corn, the fuel value of the latter would be $3.50 per ton or 12.25 cts. per bushel.

"The following table shows how much coal is worth per ton when its heating power is the same as that used in the experiment, and when corn is selling at a certain price per bushel:

Corn per bu.	Coal per ton
9 cents	$4.87
10 cents	5.41
11 cents	5.95
12 cents	6.49
13 cents	7.11
14 cents	7.57
15 cents	8.11

"It will thus be seen that if this quality of coal were selling at less than $6 50, and corn were bringing 12 cts., it would not pay to burn corn, while coal must sell as low as $5.41 per ton to be as cheap fuel as corn at 10 cts. per bushel."

The manufacture of potato starch, O. SAARE (*Die Fabrikation der Kartoffelstärke. Berlin: J. Springer, 1897*).

The sugar industry in Louisiana, F. C. THIELE (*Chem. Ztg., 21 (1897), No. 16, p. 136*).

A study of the clarification of sugar-cane juice, J. L. BEESON (*Jour. Amer. Chem. Soc., 19 (1897), No. 1, pp. 56–61*).

A review of progress in the sugar-beet industry in 1896, E. O. VON LIPPMANN (*Chem. Ztg., 21 (1897), No. 38, pp. 376–378*).

The condition of the sugar industry in Germany during 1896 (*Ber. deut. landw. Raths, 21 (1897), pp. 52–54*).—A report on the sugar production of Germany in 1896, with statistics concerning its importance and growth.

The alcohol industry (*Ber. deut. landw. Raths, 21 (1897), p. 55*).—Statistics concerning the industry in Germany from 1887 to 1895.

Progress in wine making in Aude, L. SEMICHON (*Ann. Sci. Agron., 1897, I, No. 2, pp. 292–320*).

Concerning the decreasing acid content of wine, J. WORTMANN (*Centr. Bl. Bakt. u. Par., 2. Abt., 3 (1897), No. 4–5, pp. 96–102*).

Studies on vinification in southern regions, A. MÜNTZ (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 7, pp. 331–334*).

Concerning the removal of acids from wine, H. MÜLLER-THURGAU (*Centr. Bl. Bakt. u. Par., 1. Abt., 2 (1896), pp. 707–709*).

A contribution to the study of glycerin in wine, V. SEBASTIAN (*Prog. Agr. et Vit., 27 (1897), No. 11, pp. 333–337*).

Comparative study of the composition of new red wine and a spoiled wine

made from the same variety of grapes grown in the same Algerian vineyard J. A. MULLER (*Ann. Chim. et Phys., 7. ser., 11 (1897), pp. 394–432*).

The castor-oil plant (*U. S. Dept. Agr., Misc. Circ. 1, pp. 4*).—This is a brief descriptive article on the culture of the castor-oil plant, including analyses of the seeds, preparation of the oil, etc.

Graphite instead of oil as a lubricant, THURSTON (*Oesterr. Ztschr. Berg und Hüttenwesens, 45 (1897), p. 57; abs. in Chem. Ztg., 21 (1897), No. 19, p. 56*).—Experiments are reported in which the results were very favorable to the graphite.

Progress in the tanning industry, F. H. HAENLEIN (*Chem. Ztg., 20 (1896), pp. 778–781*).—A review.

Systematic classification of textile and other useful fibers of the world, C. R. DODGE (*Science, n. ser., 6 (1897), No. 134, pp. 122–124*).—An abstract of a paper read before the Philosophical Society of Washington. The classification is as follows: A. Fibrovascular structure (1) bast fibers, (2) woody fibers, (3) structure fibers. B. Simple cellular structure (4) surface fibers.

Silk industry at the Nijnii-Novgorod Exposition (*Selks. Khoz. Lycsov., 183 (1896), pp. 241–263*).

A new method of obtaining the perfume of flowers, J. PASSY (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 14, pp. 783, 784*).

STATISTICS.

Annual Report of Kansas Station for 1896 (*Kansas Sta. Rpt., 1896, pp. I–XXIV, 247–249*).—This includes financial statements for the fiscal year ending June 30, 1896, and reports of the council giving outlines of bulletins published during the year, the general work of the station, results of irrigation work at Garden City, Oberlin, and Oakley, station personnel, a subject list of station publications since its organization, inventory of station property by departments, list of donations, and a general index of bulletins 57 to 64.

Ninth Annual Report of Louisiana Stations, 1896 (*Louisiana Stas. Rpt. 1896, pp. 12*).—A report by the director on the work of the stations at Audubon Park, New Orleans, Baton Rouge, and Calhoun during the year, with lists of station staffs and a financial statement for the fiscal year ending June 30, 1896.

Annual Report of Missouri Station for 1896 (*Missouri Sta. Rpt. 1896, pp. 16*).—This includes a financial statement for the fiscal year ending June 30, 1896; and a report by the director on the work of the year, and on the station staff, buildings, and equipment.

Report of director of New York State Station, 1896 (*New York State Sta. Bul. 115, pp. 49–74, figs. 9*).—This discusses in detail the status of the station when the present director assumed control and points out its needs. The means of distribution of station information, present and future work, important results of the year 1896, experiments carried on by the station outside of the station premises, special work in the second judicial department, and the relation of the farmers of the State to the station are discussed at some length, and a list is given of the publications issued by the station in 1896.

Report of treasurer of Utah Station for 1896 (*Utah Sta. Rpt. 1896, p. 18*).—Financial statements for the fiscal year ending June 30, 1897.

Statistics of land-grant colleges and agricultural experiment stations, 1896 (*U. S. Dept. Agr., Office of Experiment Stations Circ. 35, pp. 18*).

Constitution of the Association of American Agricultural Colleges and Experiment Stations (*U. S. Dept. Agr., Office of Experiment Stations Circ. 36, pp. 4*).—Constitution and officers and committees of the Association.

Crop report for December, 1896 (*U. S. Dept. Agr., Division of Statistics Rpt. 144, n. ser., pp. 16*).—This embraces a review of the crop conditions for 1896, estimates of the product and value of 9 important crops of the year, notes on farm prices, and statements of the condition of the winter grain crop of 1897, meteorological records, and a review of crop conditions by the European agent.

Crop report for January-February, 1897 (*U. S. Dept. Agr., Division of Statistics Rpt. 145, n. ser., pp. 7*).—Results of the yearly returns relative to the number and value of domestic animals on farms and ranches in the United States in January, 1897, together with a report of the European agent on the condition and prospects of crops in Great Britain and the Continent and an official estimate of wheat sowing in India for the present year.

Crop report for March, 1897 (*U. S. Dept. Agr., Division of Statistics Rpt. 146, n. ser., pp. 4*).—A report upon the distribution and quality of the corn, wheat, and oats crops of 1896.

Crop report for April, 1897 (*U. S. Dept. Agr., Division of Statistics Rpt. 147, n. ser., pp. 8*).—Statements are given on the condition of wheat and rye on the first of the month, and a comparison of the conditions of these grains for 1897 with that of the 6 years previous. A report is made on the condition of farm animals, by States, also percentage of losses sustained from all causes during the winter of 1896–'97.

The Mississippi River flood (*U. S. Dept. Agr., Misc. Circ. 2, pp. 6, map 1*).—This gives the population, number of farms, acreage losses, etc., in the submerged districts of the Mississippi Valley south of Cairo, Illinois, with a map showing the countries submerged or partly submerged, April 10, 1897.

The depression of corn prices and the production of wheat in some of the chief exporting countries of the world, Sir J. B. LAWES and J. H. GILBERT (*Reprint from Jour. Roy. Agl. Soc. England, ser. 3, 7 (1896), IV, pp. 723–737*).—This gives the net exports (exports minus imports) of wheat and of flour reckoned as wheat, from the chief exporting countries of the world for the years 1871–1895, inclusive, with general notes and comments on the causes affecting production in each country.

Agricultural education in Denmark (*Jour. Bd. Agr. [London], 4 (1897), No. 1, pp. 81–83*).

Importance of general and agricultural education in the matter of increasing the productiveness of labor in peasant farming, A. NOVIKOV (*Selvsk. Khoz. Lyesov., 182 (1896), pp. 665–677*).

Agricultural statistics (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 8 (1896), pp. 358–365*).—Agricultural and pastoral statistics, returned June 4, 1895, for each county in Scotland, and the quantities and values of articles affecting agriculture imported into the United Kingdom in 1893, 1894, and 1895 are tabulated.

Agricultural and pastoral statistics of New Zealand for the year 1896–'97, J. D. RITCHIE (*New Zealand Gaz. Suppl. No. 34, pp. 847–877*).—The tables give the acreage of crops sown or intended to be sown, for what purposes the crops are to be used, and the quantity of the crops now on hand from last year's harvest.

Agricultural statistics, Buenos Ayres, J. C. VERNET (*Cereales y oleaginosos trillados en la Provincia de Buenos Aires en 1895–'96, 1896, pp. 1–64*).—The report gives the acreage and production of wheat, oats, barley, rye, flax, and canary seed for the season 1895–'96.

The condition of Agriculture in Germany in 1896 (*Ber. deut. landw. Raths, 21 (1897), pp. 45–49*).—A report on the condition of crops in 1896, and tabulated statistics of the total production from 1890 to 1895, importation and exportation from 1875 to 1879, and 1885 to 1896, and the prices, during a series of years, of wheat, rye, barley, and oats.

The cereal and other crops of Scotland for 1895 (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 8 (1896), pp. 315–340*).—A comparison of the cereal and other crops of 1895 with those of the previous year, compiled from reports from different parts of the country.

The cereal and other crops of Scotland for 1896 (*Trans. Highland and Agl. Soc. Scotland, 5 ser., 9 (1897), pp. 339–362*).—A comparison of the cereal and other crops of 1896 with the crops of the previous year, prepared from reports received from various parts of the country.

Edinburgh corn-market grain tables for wheat, barley, oats, and beans (*Trans. Highland and Agl. Soc. Scotland, 5. ser., 8 (1896), pp. 348–354*).—The tables show the quantity sold, and the highest, lowest, and average prices for each kind of grain for every market day, also the results for every month and for the year 1895.

The Woburn Experiment Farm, J. A. VOELCKER (*Jour. Roy. Agl. Soc. England, 3. ser., 8 (1897), No. 2, pp. 258–292, figs. 4*).

Distribution of the principal agricultural exports of the United States during the five years ended June 30, 1896 (*U. S. Dept. Agr., Section of Foreign Markets Circ. 13, pp. 24*).

Special legislation against the adulteration of fertilizers, feeding stuffs, and seeds, M. PETERMANN (*Rapports Préliminaires 3e Congrès Internat. d'Agr., Bruxelles, 1895, pp. 37–47*).—An address.

Hamburg as a market for American products (*U. S. Dept. Agr., Section of Foreign Markets Circ. 14, pp. 10*).—Tables are given showing the value of the total merchandise imported into Hamburg, including that received from the United States during each of the 5 years 1891 to 1895 inclusive; and the total value of the merchandise exported, including that sent to the United States, during the same period; together with the report of United States Consul W. H. Robertson, giving facts and suggestions relative to our trade with that city.

Agriculture in Finland, G. GROTENFELT (*Landtbruket i Finland. Helsingfors: Wentzel Hagelstan, 1896, pp. 291, photo-engravings 11, maps 10*).—This work, by the Director of the Unstiala Agricultural and Dairy Institute, is more than a description of agriculture in Finland. It gives a complete survey of the social economic conditions of Finland of to-day, and of Finish agriculture, as will be apparent from an enumeration of the main topics treated in the book: I. Agriculture in Finland: (1) geography and topography; (2) geology; (3) climate; (4) population, distribution, occupations, etc.; (5) administration, cameralistics; (6) commerce and means of communication; (7) agriculture and agricultural products, yields, imports, and exports, agricultural machinery; (8) animal husbandry; (9) dairying; (10) forestry; (11) horticulture; (12) game and fish. II. Measures for the advancement of agriculture: (1) administration; (2) educational institutions; (3) agricultural chemical laboratories and seed control stations; (4) scientific work in agriculture; (5) agricultural literature; (6) agricultural conditions, fairs, etc.; (7) measures for the amelioration of the lack of farming capital; (8) agricultural and kindred societies; (9) agriculture in Finland's budget.

The author has been very fortunate in his treatment of the subject; the presentation is clear and succinct, and a large amount of interesting and important information concerning Finnish agricultural conditions has been incorporated in the book. The statistical and tabular matter included is from official sources, and in all cases is brought up to date. A Finnish edition of the book will be published in the near future; an English or German translation would form a most valuable addition to our available agricultural literature.—F. F. WOLL.

NOTES.

Florida Station.—The substation at De Funiak Springs has been suspended pending an appropriation from the State legislature for its maintenance. Similar action will be taken in regard to the substation at Fort Myers.

Georgia Station.—The following changes have been made in the governing board: J. T. Ferguson, of Leesburg, has been appointed, *vice* Wright Brady, and William Henderson, of Ocilla, *vice* Ben Milliken.

Massachusetts Hatch Station.—J. E. Ostrander, of the University of Idaho, has been appointed meteorologist at the station, *vice* Leonard Metcalf, resigned.

New York State Station.—E. B. Hart has recently been appointed assistant chemist at the station.

North Carolina Station.—The station staff has been reorganized as follows: Alex. Q. Holladay, chairman of council; W. A. Withers, chemist and acting director; Frank E. Emery, agriculturist; W. F. Massey, horticulturist, botanist, and entomologist; F. E. Hege, poultry manager; B. S. Skinner, superintendent of farm; A. Rhodes and C. W. Hyans, assistants in horticulture, botany, and entomology; J. A. Bizzell, C. B. Williams, H. K. Miller, C. D. Harris, A. W. Blair, J. D. Hufham, jr., and F. G. Kelly, assistants in chemistry.

North Dakota College and Station.—The college and station have in course of construction a wing for a new chemical laboratory. The laboratory, when completed, will cost $20,000. The wing will be 26 by 40 ft., one story and basement. A drill hall for the cadets is also in course of construction, and will when completed be 40 by 95 ft., with office room for military detail and gun room. Extensive repairs are also being made on several of the other buildings.

Ohio Station.—J. E. Barclay, formerly superintendent of the substation at Neapolis, is no longer connected with the station.

Oregon College and Station.—At the annual meeting of the board of regents, June 30, Thomas M. Gatch was elected president of the college and director of the station, *vice* H. B. Miller; George Coote, horticulturist, *vice* U. P. Hedrick, and Moses Craig, botanist.

Rhode Island College and Station.—Charles J. Greene, of Kenyon, has been succeeded by Jesse V. B. Watson, of Wakefield, as a member of the board of managers of the college and station.

The fertilizer-inspection law of the State has been amended so as to allow the State Board of Agriculture to employ any person whom it may elect to collect and analyze samples of the commercial fertilizers and fertilizing materials offered for sale within the State. The State Board of Agriculture is also authorized to publish the results of analysis in bulletins. The law previously in force required the work of collection and analysis to be done by the chemist of the station or his deputy, and the results to be published by the director, the expense of the work being defrayed from the fertilizer license fees. In consequence of the change in the law the analytical work has been turned over to one of several bidders, and the experiment station now has no connection whatever with the State inspection of fertilizers.

EXPERIMENT STATION RECORD.

Vol. IX. No. 3.

Few people, even specialists, outside of Russia have a just conception of the amount and quality of scientific investigation which is being carried on in that country. In the course of a compilation of the results of experiments on metabolism in man and animals, which has been made in this Office, our attention has been forcibly called to the amount of investigation in Russia on this subject and the inaccessibility of the published accounts of the work. While occasional references to these investigations were found in the English, German, and French abstract journals and yearbooks, the Russian work was not found to be followed up in the same systematic and complete manner that the work of other countries is. The difficulty of tracing out this work is increased by the fact that quite a portion of the papers are published as dissertations, and are not noticed in current scientific journals. The original publications were obtained and abstracted, and these called attention to other papers, so that eventually several hundred more or less detailed experiments on metabolism were found which were not described in any work or journal ordinarily accessible. It was found that in many lines of research on the nutrition of man and animals exceedingly interesting and valuable work had been in progress in Russia for several years. It is quite remarkable at this day that the work of such eminent scientists, in which there is quite general interest, should have remained as a sealed book to most of the civilized world. It emphasizes the desirability of our having more definite knowledge of the scientific work which is being carried on in Russia, and has already called the attention of Russian scientists to the limited extent to which much of their work reaches the outside world.

During the past summer Prof. W. O. Atwater visited the universities and other institutions of research in Russia for the purpose of looking more closely into the nature and extent of their investigations, especially in nutrition. Professor Atwater attended the International Medical Congress at Moscow in August, and visited other places in Russia and Finland, where abundant opportunity was afforded him to come in contact with the investigators and familiarize himself with the laboratories and the general character of the investigations being carried on. The results of some of his observations are outlined in the following statements furnished by him.

During the past fifty years many attempts have been made by experimenters in Europe and in this country to find means for accurately measuring the income and outgo of matter and energy in the animal organism. In a number of instances noteworthy success has been attained, as in the determination of the balance of income and outgo of nitrogen and carbon by the use of the Pettenkofer respiration apparatus in its various modifications; in the determination of the same factors and with them the heat given off from the body by the respiration calorimeter of Rubner, and of nitrogen, carbon, oxygen, and heat by the respiration calorimeter of Rosenthal. All of these are of German origin, as are the apparatus and method of Zuntz for the study of the ratio of income of oxygen and outgo of carbon dioxid, by which most interesting and valuable results have been obtained. In Sweden Sondén and Tigerstedt have devised an ingenious apparatus and method for the study of the excretion of carbon dioxid, with which very useful researches are being carried on. Accounts of the work of Atwater and Rosa in this country with the respiration calorimeter have been mentioned elsewhere.[1]

A noteworthy instance of what Russian scientists have been doing in this line is found in the researches conducted for a number of years in the laboratories of the Imperial Military Medical Academy at St. Petersburg, under the direction of Professors Pashutin, Danilevski, and Pavlov, Dr. Likhachev, and others. Professor Pashutin has devised a new and ingenious form of respiration calorimeter in which extensive studies have been made during the past twelve years upon the respiratory exchange of gases and the elimination of heat by the bodies of animals. Some five years ago a large respiration calorimeter for experiments with man was built on Professor Pashutin's plan in his laboratory under the immediate direction of one of his pupils and assistants, Dr. Likhachev, who has published accounts of the apparatus and of a number of most interesting experiments made with it. An interesting research by Dr. Studenski with the same apparatus has just been published. The respiration calorimeters of Professor Pashutin and Dr. Likhachev and the methods of experimental inquiry adopted in their use rank among the most ingenious which have been devised. Among the familiar European devices none seem to provide for more satisfactory determinations of the respiratory exchange of carbon and hydrogen and for the determination of heat given off from the body. In the same school is a laboratory of physiological chemistry under the direction of Prof. A. Danilevski. During a number of years past special attention has been given to digestive proteolysis and many results of importance have been reached. One extremely interesting observation by Professor Danilevski and his pupils was the subject of a paper presented at the Congress in Moscow. This paper showed that proteose and peptone are transformed into a substance closely resembling a coagu-

[1] U. S. Dept. Agr., Office of Experiment Stations Bull. 44 (E. S. R., 8, p. 821).

lated albumin or globulin by the action of rennet ferment. Such facts point to a possible explanation of the way in which proteoses and peptones may be changed to the albumins and globulins of blood and tissue.

A great deal of attention has been given at the Medical Academy in latter years to the study of the nutritive values of food by chemical analysis of a large number of materials in common use in Russia and by experiments on their digestibility by man. Investigators in other institutions have likewise interested themselves in this subject, so that the amount of data already accumulated in this particular field is very large. Dietary studies have also been actively prosecuted during a number of years past.

The Imperial Institute of Experimental Medicine in St. Petersburg is likewise carrying on most valuable researches. This institution is one of the best equipped in Europe. It has extensive grounds and some thirty buildings, which, with their contents, are valued at 590,000 rubles ($304,000). According to the annual report for 1895 the income of the institution for that year was about $240,000, the Government giving $67,000. The institute is devoted primarily to experimental research upon the causes of disease, especially the infectious diseases. It has six sections, each with a director and assistants, who have a laboratory and ample facilities for their work. The section of biological chemistry was established at the outset, the present director being Prof. M. von Nencki. A section of general physiology is in charge of Prof. I. Pavlov, who is also connected with the Medical Academy, and Dr. S. Winogradsky is at the head of the section of general microbiology. The head of the institute is Dr. Lukianov, who is also director of the section of general pathology. While the ultimate purpose of the institute is to obtain knowledge of value in the departments of pathology and hygiene, the broad scope and thoroughly scientific spirit of the work are such that a great deal of research is carried on which is of interest to workers in our experiment stations and to those engaged in studies on the nutrition of man. This is notably the case with the investigations of Drs. Nencki, Pavlov, and Winogradsky and their associates. Fortunately, the results of this research are published in French as well as in Russian, under the title Archives des Sciences Biologiques. It is worthy of mention that a long series of experimental investigations by Professor Pavlov on digestion and the digestive juices have been summarized in a book by him of which an edition in German is soon to appear.

The physiological and chemical institutes of the Imperial University in St. Petersburg are likewise places of active experimental research. Indeed, even a list of the scientific establishments in that city, the work of which would be extremely interesting to English readers if it could be better known by them, would be too long for insertion here.

While no other city in Russia can compare with St. Petersburg in its scientific institutions, a great deal of excellent work is being carried on in connection with the universities, technical schools, and experiment stations in Moscow, Charcow, Kiew, Helsingfors in Finland, and elsewhere. The physiological institute of the University of Moscow, under the direction of Professor Morokovitz, may be mentioned as an example in this connection.

In agricultural science less has been done thus far in Russia than in several other departments of knowledge. A fortunate beginning has, however, been made. The work of Professor Thoms in Riga has long been known outside of Russia, and has been frequently noted in the Record. A number of agricultural schools and experiment stations have already been established. The recently established institution at Moscow which combines a school and experiment station is a noteworthy illustration. Several experiment stations have been started in other parts of Russia, but the enterprise is new and the work is largely of a practical kind, consisting of field experiments, tests of methods of culture, and the like, prosecuted on large estates by coöperation with owners. The ministry of agriculture at St. Petersburg is interesting itself greatly in this subject and has appointed a scientific commission to consider matters pertaining to agricultural science and instruction and aid in promoting these interests. The chairman of this commission is Professor Tcherwinsky, whose investigations, notably those upon the development of the animal skeleton, are already known in Europe and the United States. A series of experimental studies by the same author upon the effect of food upon the development of the bones of animals have been published in Russian, but unfortunately have not become known to readers unfamiliar with that language.

The University of Helsingfors in Finland has lately planned the establishment of an agricultural department coördinate with its other departments. It will be of interest to educators and friends of agriculture in our own country to know that a commission of the university to whom the planning of this agricultural department was intrusted have, after studying such institutions in different countries, proposed a plan based upon that of a number of State universities in the United States which have agricultural departments. It is understood that this plan will be adopted.

While the development of agricultural science in Russia is new, the beginnings are such as to give promise of large results in the future. Already much has been accumulated which would be of great interest to us if it could be made available. The names might be cited of a considerable number of institutions and individuals whose contributions to knowledge in various scientific specialties entitle the scientific work of Russia to a high rank in comparison with that in other countries. Indeed, the advance in this respect in Russia in later years is hardly less than phenomenal. And it should not be forgotten that this advance includes much of interest and value for our agricultural schools and experiment stations as well as for the larger public interested in agricultural and other sciences in the United States.

Mention has been made of the slowness with which the results of Russian inquiry are becoming known in the rest of the world. The reason for this is simple. The accounts are published almost exclusively in Russian. Furthermore the practice of collating the results and publishing them in the form of abstracts and monographs which is so common in western Europe and the United States has not been developed in Russia, so that the specialist who would know what is being done in that country is under the necessity of collating it from a large mass of scattered literature which is difficult to find and obtain and is in a language which very few outside of Russia are able to read. The desirability of an improvement in this matter, rendering the results of Russian inquiry available to the outside world, is becoming apparent, and it is hoped that before long the fruits of Russian inquiry may be made more readily available to English readers. Arrangements have already been made for preparing abstracts of agricultural investigations directly from the Russian for the Record.

All recent investigations on the ripening of cheese have started out from the generally accepted principle that the changes in the casein were due to the action of bacteria or other microörganisms. By many investigators the change was believed to be due to peptonizing bacteria, and an abstract of a Russian article, given in this number, reports what was intended as additional evidence in support of this view. The author (Shirokih) studied the change in the casein of milk inoculated with pure cultures of peptonizing bacteria, lactic acid bacteria, etc., and concluded that the peptonizing bacteria and the fungus *Oïdium lactis* were responsible for all the changes.

In opposition to this view, Dr. Russell, of the Wisconsin Station, has found that the number of peptonizing bacteria in ripening cheese diminishes rapidly from day to day until very soon these bacteria are almost entirely eliminated. This occurs before there is any evidence of physical change in the casein. He is convinced that the peptonizing bacteria do not act the same in green cheese as they do in milk, for the conditions in the cheese seem to be unfavorable for their growth.

Continuing his investigations on the cause of the change, in colaboration with Dr. Babcock, of the same station, a discovery has been made which throws a new light on the question. Only a preliminary account of this investigation has yet been published. In some experiments with milk treated with an antiseptic it was noticed that the milk curdled and underwent digestive changes resulting in products similar to normally cured cheese. This suggested the presence of an enzym or enzyms in normal milk; and in further experiments where the possibility of bacteriological action was precluded, the presence of such unorganized ferments was shown conclusively. By physiological methods extracts were prepared from separator slime which contained these enzyms in a r atively pure state. Their number and character have not been studied in detail, but they were found to be more closely allied to the tryptic than to the peptic class. When the extracts were added to milk and cheese they hasten the breaking down of the casein. Finally, cheese was made from mill hich was kept under chloroform to preclude the action of bacteria, and the same cheese was kept in a saturated atmosphere of chloroform for a long period to observe the ripening. Under these conditions bacteriological growth was impossible, but the cheese ripened as fast as normal cheese kept under favorable conditions. It appears, therefore, that as far as the peptonizing of the casein is concerned by far the larger part of it is due to the action of unorganized ferments which occur normally in milk rather than to the action of bacteria.

The reasons why other investigators have failed to find these substances is because they have adhered too closely to the usual bacteriological methods. For instance, they have usually worked with milk sterilized by means of heat alone, and then planted in the sterile milk cultures of various organisms in order to determine their peptonizing effect. In this way they have eliminated the action of these inherent enzyms. It was not until antiseptics were employed for sterilizing that the keystone to the whole question was discovered.

In this connection some entirely independent experiments recently reported by Jensen in Denmark, noted in this number, are especially interesting. He made experiments in ripening cheese with the aid of trypsin. Pasteurized milk was used, and a preparation of pancreas was kneaded into the cheese curd before putting it to press. As a result of this work Jensen concludes that the ripening of cheese is largely due to the action of an enzym (casease) very similar to trypsin, but he adduces no evidence to show the occurrence of such an enzym in normal milk or to explain its presence in cheese curd.

Drs. Babcock and Russell have definitely proved the occurrence of enzyms in milk and their causal relation to the ripening of cheese, and have thus added one of the most important contributions of biological chemistry to agriculture from both a scientific and a practical standpoint.

THE AIMS AND TENDENCIES OF THE GERMAN AGRICULTURAL EXPERIMENT STATIONS.[1]

Prof. M. Maercker, Ph. D.,

Director of the Agricultural Experiment Station at Halle, Germany.

SCIENTIFIC INVESTIGATIONS.

The agricultural experiment stations should extend our knowledge of the principles underlying agriculture by conducting scientific investigations. These investigations should extend to the nutrition of agricultural plants and domestic animals. The fundamental investigations carried on since the fifties on plant nutrition have given us quite definite knowledge. From the water and sand cultures of Sachs, Knop, Nobbe, Hellriegel, and others we know in general the separate elements of plant food and the proportions in which they should be used; and from this a rational basis for manuring agricultural plants has been deduced.

But work still remains to be done in this field. Although we know what fertilizing constituents are used by plants, we are far from knowing what part each plays in the plant economy and what relation it bears to the formation and building up of the separate constituents of the plant. In this connection reference may be made to the latest investigations of Hellriegel on the relation of potash to the formation of sugar in the sugar beet. In spite of the magnificent results of these investigations, they did not completely solve the problem. The rôle of lime and magnesia in the growth of plants is likewise not definitely known and requires further investigation. Furthermore, according to recent investigations by Hellriegel and Wilfarth, we must assume that a certain replacement of potash by soda may take place in plants. This may be of extensive practical interest, since the crude Stassfurt potash salts, containing soda, would be more economical to use than the pure potash salts.

There are many similar questions in this line. Hence investigations by methods of pure culture in water and in sand must be continued by experiment stations in the near future, even though the work be confined to only a few stations.

The classic investigations of Hellriegel have given us an entirely new point of view as to the nutrition of leguminous plants. We know

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[1] Continued from page 113.

now that the Leguminosæ are able, by means of root tubercles and probably through the microörganisms contained in them, to convert the atmospheric nitrogen into combined forms and thereby to enrich the soil in the nitrogenous compounds so useful in plant nutrition. Hence the Leguminosæ are rightly called the nitrogen gatherers among cultivated plants, and are widely cultivated both as a crop to be harvested and as a green manure, either as the principal crop or as a catch crop.

There are many questions in connection with these nitrogen gatherers which are not yet settled. It remains to be studied what leguminous plants are the most active nitrogen gatherers in the different soils, and under what conditions this assimilation is most active. The question of inoculation is an important one in this connection. It was first used practically by Salfeld, and was worked out scientifically by Nobbe. The latter found that the microörganisms in root tubercles could be grown artifically, and that they could be transplanted to the different leguminous plants when the latter were grown in soils containing no microörganisms or an insufficient number. Nobbe calls the pure cultures prepared by him Nitragin. He proposes by introducing the pure culture into the soil near the germinating plant to stimulate the plant to an active tubercle formation and consequent assimilation of nitrogen. His experiments show that under certain conditions this actually takes place, but the application of this in practice has not been tested to any considerable extent. It is for the experiment stations to study this matter thoroughly, and they are already extensively engaged with it.

Such investigations as these are concerned with the important question of a cheap supply of nitrogen for cultivated plants. This question is for Europe at present a most important one, since all old soils, as explained above, are very deficient in nitrogen and require for their cultivation large applications of expensive nitrogenous fertilizers—nitrates, ammonia salts, etc.

Of equal importance in this connection is the conservation of the nitrogen in barnyard manure. Since in Germany stall feeding is the rule and pasturage the exception, the barnyard manure is naturally of unusual importance and is quite indispensable, both on account of its mechanical and chemical action and especially because it provides the soil with nitrogen.

Recent investigations have demonstrated that with the present method of preserving and handling barnyard manure, there are very large losses of nitrogen, which may be estimated at about 25 kg. annually per head of live stock. The tremendous loss which this represents in the aggregate may be realized from the fact that there are in Germany about 20 million head of live stock (large animals), which means a total loss of 500 million kg. (550,000 tons) of nitrogen each year. If only a small part of this loss could be prevented, it would be a great addition to the national wealth and the experiment stations are in the best position to accomplish this desirable result. Their experiments on the causes of this loss have already shown that it is not due to the volatilization of the ammonium carbonate of the manure alone, but also to the action of microörganisms which decompose nitrates (denitrification). The investigations especially of Professor Wagner in Darmstadt have made important contributions to this subject. As a result of these observations the agricultural experiment stations have commenced to study the problems relating to barnyard manure from the bacteriological side. From what has already been learned of the part played by microörganisms, it is evident that the problems can not be solved by purely chemical means.

The investigations of Stutzer and Burri, of the agricultural experiment station at Bonn, are also along this line, and have already resulted in important contributions on the activity and the life conditions of the microörganisms which decompose manures. This work requires confirmation and should be extended.

The agricultural experiment stations will necessarily undertake the bacteriological study of these problems on a large scale, and must add bacteriologists to their permanent working force. These can also be utilized in other lines of inquiry.

The experiment stations are also conducting chemical studies on the losses from barnyard manures with a view to preventing the loss of nitrogen as far as possible by preservatives. In this line also noteworthy results have been obtained by agricultural chemists, especially through the aid of the German Agricultural Society.

The results which are being obtained and the interest manifested by the stations in the subject give encouragement that in the near future the questions relating to barnyard manure will be fully solved.

An indispensable aid to the investigation of the agricultural chemist in this field of inquiry as well as in all others relating to fertilizers, are vegetation experiments. These were first employed on an extensive scale by Professor Wagner, of Darmstadt. By means of vegetation experiments, carried on in suitable pots, partly out of doors and partly in greenhouses, the indications from laboratory investigations are tested under well-defined conditions. As an example of this it may be mentioned that the Halle experiment station found in its investigations on barnyard manure that the efficiency of the manure did not always correspond to what would be expected from its chemical composition, *i. e.*, the nitrogen compounds found by chemical analysis. The question of the action of nitrifying organisms comes into account and this can only be solved by vegetation experiments.

For these reasons many German experiment stations are at present providing themselves with vegetation houses, in order to take up the most extended research in this line. Vegetation experiments are of course not merely suited to studying the nitrogen nutrition of plants but can also be used in solving other problems in manuring. Formerly it was necessary to conduct very tedious field experiments, involving many sources of error, in order to determine the efficiency of an artificial fertilizer. Vegetation experiments enable the experimenter to eliminate the outside disturbing influences and conditions, and to place the plants under conditions which bring out the efficiency of the fertilizer or ingredient which is being tested. Every new fertilizing material which makes its appearance can now be tested as to its value in vegetation experiments. The bearing of these vegetation experiments can be illustrated by the case of Thomas slag, which is at present used more extensively in Germany than any other phosphate, much to the advantage of agricultural production. The rapid introduction and widespread use of this material is due to the results obtained with it by Professor Wagner in vegetation experiments. Field experiments could never have brought about such a rapid extension in the use of Thomas slag.

It should not be understood, however, that the vegetation experiments have rendered field experiments unnecessary. On the contrary, to apply the results of vegetation experiments to actual practice on a large scale field experiments will always remain indispensable; but the fundamental scientific questions can not be answered by field experiments. For this purpose vegetation experiments must always be relied upon.

The vegetation experiment is also coming into extensive use by the German experiment stations for another purpose; namely, for studying the fertilizer requirements of soils. Chemical analysis, as explained above, is by no means suited to determine with certainty the fertilizer requirements of an agricultural soil. This is best accomplished by vegetation experiments, *i. e.*, through the analysis of the soil by the plant.

This method of determining the fertilizer requirements of the soil is extensively used at the Halle station for the benefit of the farmers of the Province of Saxony. By this means the farmers learn on which soils they can omit certain fertilizers and on which they must apply the same in large amounts.

Finally the agricultural experiment stations must attack the questions of animal nutrition in similar manner. Heretofore the digestibility of the constituents of the various feeding stuffs have been studied with profitable results, and on the basis of these investigations practical tables showing the digestibility of feeding stuffs[1] have been prepared. On the basis of the feeding experiments which have been made, feeding rations for animals, containing the proper amounts of digestible nutrients for the most advantageous production, may be compounded from different feeding stuffs. Much remains to be done, however, in solving the more intricate problems relative to animal nutrition, and for this respiration experiments are important. The natural laws of the nutrition of Herbivora are, in spite of much research, not fully understood, and Henneberg's classic investigations on this subject

[1] See the extensive compilation of Dietrich and König.

require supplementing and further extension. This has been undertaken by several experiment stations possessing respiration apparatus, especially the experiment stations in Moeckern and Göttingen Recently an excellent investigation in this line was published by Prof. O. Kellner, of Moeckern, on the metabolism of matter and energy in mature cattle.[1]

It is self-evident that the agricultural experiment stations must also exercise a continual control over the plant diseases and the injurious insects affecting cultivated plants. In Germany, as the research work of the experiment stations is otherwise very large, these lines of investigation have been intrusted to special institutions. For example, the institution originally established for the repression of beet nematodes at Halle, the division for plant protection of the German Agricultural Society, and others are working in this direction.

In the course of time a division of the field of work became a matter of necessity to the agricultural experiment stations, on account of the extent of the executive work involved. For this reason special experiment stations have been established in Germany for agricultural industries. These stations do not confine themselves to the technic of these industries but study the culture and production of the agricultural products which are employed in these industries. The most important of these industries are the manufacture of sugar, alcohol, and starch, and the brewing of beer. The latter industry especially has provided an excellent plant for work, both from an agricultural and a technical point of view. The station for potato, barley, and hop culture conducted by Dr. von Eckenbrecher is devoted to determining the value of the new varieties of these crops for industrial purposes. It carries on extensive experiments every year on the value of the large number of varieties which make their appearance, the claims for many of which were formerly found to be wholly unjustified. Every new variety is tested at the culture station, and those which are not found suitable are at once excluded, while formerly a long practical experience was necessary in order to reach a decision.

It may be mentioned in passing that the experiment station for alcohol and starch manufacture and beer brewing, conducted by Professor Delbruck, has contributed a long list of classic investigations of the greatest importance to the theory and practice of the agricultural industries.

THE PRACTICAL APPLICATION OF THE RESULTS OBTAINED IN VEGETATION AND FEEDING EXPERIMENTS.

The lines of investigation enumerated above are well adapted to working out the scientific principles of agriculture, and the German experiment stations have made extensive and valuable contributions

[1] Landw. Vers. Stat., 47 (1896), p. 275; E. S. R., 9, p. 167.

in this direction. But the crowning feature of such work is the demonstration of its practical bearing and its application in farm practice. The deductions from these investigations must be tested in actual practice. This work naturally falls to the agricultural experiment stations and has grown to be a very important function. Its importance was for a long time not fully appreciated by the agricultural experiment stations in Germany. This was unavoidable, as the scientific principles were far from being demonstrated and absorbed the attention of the stations. But as this has now been accomplished to a considerable degree in most lines, the stations are taking up the highly important task of testing the progress of science as to its practical bearing, and of applying in practice the observations which stand these crucial practical tests. From a practical standpoint, this branch of the work is at present at least fully as important as the scientific research.

As long as the condition of agriculture in Germany was good, the experiment stations had no difficulty in finding practical farmers who would coöperate with them in such practical experiments. But in the present depressed condition it can not be expected that individual farmers will make any considerable sacrifice for the general good, such as would be involved in conducting extensive field experiments on the practical application of scientific teachings. As long as the condition of agriculture was good it was not necessary that the experiments carried on by practical farmers should be such as always to give entirely practical results, and in fact under such conditions the farmers could be encouraged to conduct experiments which it was known would be of more theoretical than practical interest. The writer has at times not hesitated to organize coöperative field experiments in his district the cost of which would amount to upward of $25,000 annually, and this expense was willingly borne by the farmers; but in the present depressed condition of agriculture the farmers can not be expected to carry on experiments which are not likely to be of direct benefit to practical agriculture.

On this account it is extremely desirable to submit problems for field experiments to a selective process, in order to prevent unnecessary expense to the farmers. For this purpose it has been found necessary for the experiment stations to provide their own experiment fields for investigations in manuring and in the production and management of barnyard manure. On these fields the problems which suggest themselves for coöperative experiments with farmers can be sifted and a selection made of topics to be studied in such experiments.

The experiment stations must be provided with sufficient funds to enable them to conduct field experiments on the important questions of the day without regard to the expense or to the profitable returns. A large number of the experiment stations already have such experimental fields, and it will be necessary to provide these for every experiment station which is engaged in studying the problems of plant nutrition. In the case of a number of stations it will be necessary to go further and follow the example of the United States, where a large number of the experiment stations have experimental farms on which not only the problems in manuring, but also in feeding are studied on an extensive scale. The writer, on his tour of the United States in 1893, became convinced of the necessity and the utility of such experiment farms, and as a result of his report on this subject the Prussian Government provided the experiment station at Halle with an experimental farm and sufficient means for its maintenance. Undoubtedly other German experiment stations will be provided with such farms. The plans of the writer contemplate two more such farms in connection with the Halle station. As the first one is on a humus loam soil, especially adapted to the growth of sugar beets, it is planned to have one on a sandy soil and a third on a heavy clay soil.

It will not be necessary for all the experiment stations to have such farms, but the establishment of a number of them in regions of Germany having different climatic and soil conditions will undoubtedly be necessary to test various scientific questions in a practical way.

These experimental farms will in no way render the coöperation of the practical farmer superfluous, but they will be used for testing in a preliminary way and excluding such experiments as it is apparent would be unprofitable for the practice. The experimental farms will be a connecting link between science and practice and will save the farmers the expense of unprofitable experiments. On these experimental farms will be studied not only the action of artificial fertilizers, but also the important questions connected with the production and management of barnyard manure, as stated above. Furthermore the large number of new varieties of agricultural plants which make their appearance every year, often with extravagant claims for them, must be studied and those which prove valuable for practice indicated. In addition the farms will furnish especially an opportunity for practical experiments in feeding, in connection with which experiments in the production of barnyard manure can be carried on.

Although coöperative field experiments with practical farmers present many difficulties, the carrying on of feeding experiments under such conditions is far more difficult, and farmers usually have not the necessary experience or facilities for conducting feeding experiments which are of any use. The experimental farms can relieve the practical farmer of this work entirely. They can reach conclusive results much sooner, because the results of feeding experiments are far less dependent upon outside conditions than those of fertilizer experiments; and with the coöperation of the experiment stations in this line many results of practical value to agriculture may be expected.

The director of an experiment station may always profitably undertake to induce the farmers of his district to take up experiments of all kinds. The writer knows the advantages of this from practical experience. The German farmer is by nature distrustful. Although he has the highest respect for a scientific institution, he invariably regards it with a certain distrust and doubts the applicability of the results obtained from experiments at a scientific institution to his own conditions. But if he conducts an experiment on his own fields and obtains profitable results, both he and his neighbors are convinced of the correctness of the teachings of science.

It is, therefore, a highly important function of the experiment stations to organize field experiments, not only for research, but also for purposes of furnishing to the farmer a practical demonstration of the usefulness and benefits of scientific research.

The director of an experiment station must therefore be in close sympathy with the practice of agriculture. He must be accurately posted as to the methods employed by the farmers of his district and must possess sufficient practical information to be able to test these methods critically. If this practical understanding is lacking, the experiment station will fall far short of the usefulness in promoting agriculture that may reasonably be expected of it. The writer by no means underestimates the value of the work of the experiment stations in the promotion of agricultural science, and believes that he has not been unmindful of his duty in this direction, but the crowning feature of scientific attainments must be the application of these discoveries to practice, and to this end it is absolutely necessary that the practical farmer should be induced to coöperate in the study of questions of manuring, introduction of various kinds of cultivated plants, cultivation of the soil, etc.

An important means to this end are the lectures and the teaching of the directors of the agricultural experiment stations. The director of a station can not confine his energies to the laboratory and experiment field. He must go out among practical farmers and talk over the live questions of the day with the leading agriculturists, and above all he should attend the meetings of agricultural societies, in which are found large numbers of farmers who are ready and willing to be instructed. Here he must win friends for his experimental work by demonstrating his scientific and practical grasp of the subject. If an experiment station would become popular and win the confidence of the farmers, without which its work is of no real advantage, its officers must be in touch with the practical farmers of the region.

The effort has been made above to show the manifold duties and the broad field of activity of the agricultural experiment station, and it will be apparent to the reader that the accomplishment of all these requirements by a single agency is entirely out of the question. Hence, very naturally, a division of work has grown up in Germany, under which different stations, from their special needs and perhaps also from the tastes of their directors, have preferred to apply themselves to separate fields of work. We have then to distinguish the following aims of the experiment stations in Germany, which are commonly indicated as specialties, although some large stations with abundant means are able to carry on several of these branches:

(1) The exercise of control—
  (*a*) Experiment stations for the examination of fertilizers and feeding stuffs.
  (*b*) Seed-control stations. The number of stations occupied with seed control is small.
(2) Experiment stations devoted especially to plant nutrition, problems in manuring, and soils.
(3) Experiment stations devoted primarily to investigations in animal nutrition.
(4) Dairy experiment stations.
(5) Experiment stations for agricultural industries.
(6) Experiment stations for plant protection.

ASSOCIATION OF GERMAN EXPERIMENT STATIONS.

As has been mentioned in the course of this article, the German experiment stations were not organized by the states, but for the most part were founded by the combined effort of private farmers; and it follows from this that in the nature of the case they could not have a uniform organization. The need of mutual sympathy and support is naturally not less among the German stations than among those of other countries. This need found expression at the very beginning in voluntary annual meetings of the stations at the larger stations in different parts of Germany. These conventions were devoted to scientific discussions on the important questions of the day. Whenever it was practicable to unite upon analytical methods special meetings were held for the purpose, without, however, forming a permanent association. The apparently loose union of the German experiment stations and the voluntary attendance on the meetings have been materially strengthened by the excellent organ which they have, *Die landwirtschaftlichen Versuchs-Stationen*, edited by Professor Nobbe, in which expression can be given to the views and desires of the stations.

The gradual abandonment of the separate meetings of the stations and their organization as a section of the Association of German Naturalists and Physicians did not tend to strengthen the union of the stations. The special problems came to occupy a more subordinate place, and the attendance on these section meetings was materially smaller than that of the former meetings of specialists. As a result of this a certain estrangement grew up between individual stations, which made it apparent that a closer union and a stronger organization was an urgent necessity. This was accomplished, with the coöperation of all the German stations, by the formation of the Association of Agricultural Experiment Stations in the German Empire, at Weimar, January 22, 1888. The constitution of this association is given at the conclusion of this article.

This association has developed along various lines, and its field of activity has become very broad. It embraces not only the matter of analytical methods, in which uniform methods are agreed upon for the examination of fertilizers and feeding stuffs, and studies made of the methods by committees appointed for the purpose, but it also includes other lines, as, for instance, defining the meaning of terms applied to certain agricultural supplies, as bone meal, bran, etc.; testing feeding stuffs as to purity and general condition; fixing the basis of valuation of the separate nutrients of feeding stuffs;[1] training and placing of assistants; methods of sampling fertilizers and feeding stuffs; methods of soil examination; the principles of rational estimation of the value of fertilizers, as that of Thomas phosphate meal according to its content of citrate-soluble phosphoric acid, Chile saltpeter according to its nitrogen content as determined by the direct method; the establishment of the limits of variations of analyses from the standard; the conduct of the fertilizer control; the appointment of a jury to pass upon contested analyses of fertilizers and feeding stuffs; the conduct of seed control; the guaranteeing of seeds; the calculation of the value of grass and other seeds; the testing of the quality of feeding stuffs from a chemical and bacteriological point of view; the attitude of the experiment stations toward the fertilizer and feeding stuffs manufacturers and dealers; and various other allied questions.

As this association of experiment stations has proved entirely satisfactory and of great usefulness, the need of a federal organization has not been felt in Germany. In fact it is not regarded as desirable in the case of most of the stations that the Federal Government should interfere with this organization which has discharged its duties so admirably.

CONSTITUTION OF THE ASSOCIATION OF AGRICULTURAL EXPERIMENT STATIONS IN THE GERMAN EMPIRE.

SEC. 1. Every agricultural experiment station in the German Empire established by or maintained in the interest of the public by the state, provincial authorities, or an agricultural corporation affiliated with a central agricultural union, and including the agricultural experiment stations connected with the agricultural institutes (Hochschüle), is entitled to membership in the Association of Agricultural Experiment Stations in the German Empire.

SEC. 2. The object of the association is the mutual advancement of the interests and aims of the experiment stations along scientific and practical lines, and especially the securing of the greatest practicable uniformity in the examination and control of fertilizers, feeding stuffs, seeds, and other important agricultural supplies.

The rights and obligations of the authorities or corporate bodies of the experiment stations shall not be encroached upon.

SEC. 3. The association shall choose a directorate to conduct its affairs, consisting

[1] This work is conducted by Professor König, of Münster, in the interest of the association.

of the directors of five stations embraced by the association, whose term of office shall be three years.

The directorate shall choose a chairman from its number, and a vice-chairman.

The directorate is authorized to fill vacancies in its number occurring during its term of office, and in case an absent member is elected by the association and declines to serve it may fill the vacancy temporarily until the next meeting, when the association will make another choice.

SEC. 4. It shall be the duty of the directorate to represent the association in its external relations, to call a general meeting of the association annually, and to make the necessary arrangements for this meeting. The daily program of this meeting shall be issued to the members at least four weeks previous to the meeting.

SEC. 5. Furthermore, the directorate shall choose for terms of three years standing committees for studying various analytical problems as follows:

(1) The examination of fertilizers.

(2) The examination of feeding stuffs.

(3) Soil analysis.

These committees are required to investigate the analytical problems within their scope, as suggested by their members, by the directorate, or by a member of the association and approved by the directorate, with a view to preparing a report for the instruction of the general meeting.

The directorate may call the committees together whenever it seems desirable.

In urgent cases the committees shall report the result of their investigations and conferences as soon as practicable to the chairman of the association, who shall determine whether or not a special general meeting of the association shall be called. In ordinary cases the report shall be made at the next general meeting.

SEC. 6. On motion of three members of the directorate, substantiated by evidence, the methods considered doubtful shall be recommitted for further investigation, and a report made at the next general meeting.

The motion shall be first submitted to the committee in whose province it falls. After the committee has reported upon it, the chairman of the association shall decide whether or not the motion is to be regarded as well founded, and then treat the matter accordingly.

The standing committees shall communicate to the chairman of the association the proposed plan of investigating the methods prior to beginning the work; and the chairman shall notify the members of the association at once so that they may voluntarily take part in the work.

SEC. 7. The institutions belonging to the association shall be represented at the meetings by their technical directors. Where there are several directors of equal rank, they shall choose one from their number to represent the institution. In case the director is not able to attend, he may designate a member of his scientific staff to represent the institution.

The right of an institution to come into the association shall be determined at the general meeting.

SEC. 8. The general meeting of the association shall be held if practicable in connection with the convention of German Naturalists and Physicians, but not coincident with it, and when possible in a neighboring town where a German experiment station is located.

The chairman of the directorate shall preside over the conventions of the association.

SEC. 9. The directorate is empowered in special cases to call special meetings. At the request of at least three members it is required to call a special meeting.

SEC. 10. The German Agricultural Council (*Deutscher Landwirthschaftsrat*) shall be notified by the directorate of the place and time of meeting and the daily programme at least three weeks prior to each meeting, and may send a representative to the meeting.

SEC. 11. The directorate is authorized to invite specialists who do not belong to the association to participate in its meetings.

SEC. 12. In matters of pure business the directorate shall be guided by the wishes of the majority of those entitled to vote.

In technical analytical questions the unanimous vote of those present is required to make the resolution binding.

On purely scientific questions no resolutions passed shall be binding.

SEC. 13. The resolutions passed at a convention shall be ratified at the next general convention.

SEC. 14. To defray the necessary expenses an annual fee shall be collected from each institution belonging to the association. The amount of this fee shall be determined each year by the general convention, but shall not exceed 30 marks. Members of committees shall be allowed their expenses while attending committee meetings, in so far as these are not in connection with the general convention, including a per diem of 12 marks, railroad fare for second-class ticket, and other necessary expenses according to the customary regulations in the Kingdom of Saxony.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The determination of the fermentable substances present in cereals, J. EFFRONT (*Monit. Scient., 1897, p. 270; abs. in Chem. Centbl., 1897, I, No. 18, p. 950*).—Numerous experiments have shown that treatment with mineral acids in the cold gives results corresponding to the actual amount of fermentable substances present. The results were controlled by fermentation analyses. The failures recorded with the latter must be ascribed to the fact that the nature of the yeast used and the conditions of fermentation have been only superficially considered. The yeast used must be well characterized and the conditions must be such as to exclude the development of foreign yeasts. The starch may be accurately determined by solution in hydrochloric acid, when the cereal is very finely ground and the fat removed. Three grams of the flour is treated with ether on a filter, dried one-half hour at 100°, transferred to a glass mortar, and mixed with 20 cc. concentrated hydrochloric acid, which must be added in small quantities to avoid the formation of lumps. The process must be completed in six minutes, when the action of the acid will be limited to the starch. The mixture is transferred to a 100 cc. flask, containing some water, diluted to the mark, and immediately filtered. Seventy-five cubic centimeters of the filtrate is nearly neutralized, evaporated, redissolved, the solution again made up to 75 cc. and filtered. It is then polarized and the dextrose determined with Fehling's solution. The excess in rotation is calculated to dextrin.—W. H. KRUG.

A new synthesis in the sugar group, H. J. H. FENTON (*Jour. Chem. Soc. [London], 71 (1897), No. 413, p. 375*).—Dihydroxymaleic acid which is formed by the oxidation of tartaric acid in the presence of iron can be almost quantitatively decomposed into glycolylaldehyde and carbonic acid by heating with water. Glycolylaldehyde undergoes a peculiar change when heated *in vacuo*, and is transformed into a sweet, solid gum, having the composition $C_6H_{12}O_6$. This condensation product is soluble in water, and reduces both Fehling's solution and ammoniacal silver nitrate solution rapidly. It exhibits several characteristic sugar reactions, and forms with phenylhydrazin a normal hexose $C_{18}H_{22}N_4O_4$, melting at 168 to 170° C. It is optically inactive, is not fermented by yeast, and on heating with water to 140° C. gives furfurol. The purified "sugar" loses water when heated *in vacuo* to 100 to 106° C., becomes hard and brittle, and after 4 hours has the composition $C_{12}H_{22}O_{11}$. When heated for 24 hours the composition becomes $C_6H_{10}O_5$. The conditions under which tartaric acid is oxidized by atmospheric oxygen are present during the growth of the plant, and the formation of this "sugar" may be of importance in connection with the production of carbohydrates in the vegetable kingdom.—W. H. KRUG.

Melibiose, A. BAU (*Chem. Ztg., 21 (1897), No. 21, p. 186*).—To obtain the material for the investigation melitriose was inverted with acid or fermented in a 10 per cent sterilized solution with surface yeast. The products obtained by fermentation showed $(\alpha)_D = +126.88 - +137.50$ at 17.5° C. in a 2 dm. tube, while those obtained by inversion gave $(\alpha)_D = +137.32$ or $+139.34$ for ash-free substance. The reducing power of melibiose, which was formerly given as 83 per cent of that of maltose, was found to be 90 to 93 per cent, was higher the more dilute the solution, and increased as the time of boiling was extended. Melibiose can only be inverted by melibiase and not by invertin (euinvertase). It is inverted by hydrochloric, sulphuric, and oxalic acids, while lactic, tartaric, and citric acids have no action. *Saccharomyces apiculatus*, *Schizosaccharomyces* Pombe Lindner, and *Saccharomyces* Logos van Laer do not act on melibiose; the latter two slowly split melitriose into δ-fructose and melibiose.—W. H. KRUG.

The formation of mannan in Amorphophallus konjak, M. TSUKAMOTO (*Imperial Univ., Coll. Agr., Tokio, Bul. 2, p. 406; abs. in Chem. Centbl., 1897, I, No. 18, p. 933*).—The leaves of *Amorphophallus konjak* contain little starch and considerable mucilage, which was found to be an anhydrid of mannose. This fact makes it probable that the mannan play the rôle of starch in the leaves, although it is not certain that mannose is the first product of assimilation. Mannose was found in the stems.—W. H. KRUG.

The action of diastase on starch, A. R. LING and J. L. BAKER (*Jour. Chem. Soc. [London], 71 (1897), No. 414, p. 508*).—The limited action of diastase on starch at 70° C. gives the following unfermentable products: α-maltodextrin, $C_{36}H_{62}O_3$, identical with the maltodextrin of Brown and Morris, but having $(\alpha)_D = 180°$ and reducing power $R = 32.81$; β-maltodextrin, $C_{24}H_{42}O_2$, identical with Prior's acchroodextrin 3, having $(\alpha)_D = 171.6°$ and $R = 43$. From the unfermentable residue of that fraction, which Lintner designated isomaltose, a substance was isolated which has the composition $C_{12}H_{22}O_{11}$ and is isomeric with maltose. It has $(\alpha)_D = 156°$ and $R = 62.5$, and may be the simple dextrin $C_{12}H_{20}O_{10}$, H_2O. The results indicate that the hydrolysis of starch by diastase yields a series of successive maltodextrins of lower molecular weight and rotatory power and higher reducing power.—W. H. KRUG.

The quantitative separation of the cellulose-like carbohydrates in plants, W. HOFFMEISTER (*Landw. Vers. Stat., 48 (1897), No. 6, pp. 401–411, fig. 1*).—The hemicellulose, cellulose, and lignin were determined in a number of feeding stuffs by the following method: The substance extracted with ether is treated at ordinary temperature with dilute acid (HCl) and ammonia, previous treatment with malt extract being employed in case of materials rich in starch. The extraction with acid and ammonia is made as exhaustive as possible, preferably by successive treatment and decanting or siphoning off the liquid. The residue is treated without drying with 5 or 6 per cent sodium hydrate for one or two days, being frequently stirred, the solution diluted, allowed to settle and then decanted or siphoned off. This sodium-hydrate extract is neutralized with hydrochloric acid, plenty of alcohol added, and the precipitate (hemicellulose) collected on a filter, dried, and weighed. The residue from the extraction with sodium hydrate is washed on a filter with hot water, treated with Schweizers' reagent, and the extract precipitated with alcohol as above, giving cellulose. The insoluble residue (woody substance or lignin) is washed, dried, and weighed. It is recommended to wash each of the 3 products with ammonia to prevent charring during drying.

The following table gives the results of several determinations:

Cellulose-like carbohydrates in feeding stuffs.

	Hemicellulose (pentoses).	Cellulose.	Lignin.
	Per cent.	*Per cent.*	*Per cent.*
Wheat bran	17.58	5.40	5.10
	15.85	4.79	6.28
Linseed cake	2.25	3.36	5.61
	2.40	3.55	6.05
			6.30
Cake from seed of *Camelina sativa*	Trace.	1.28	12.07
	Trace.	2.67	11.33
Rye bran	16.80	2.49	5.94
Rape-seed cake	Trace.	2.85	8.62
Hemp-seed cake	2.52	1.55	26.28
Kernel of sunflower seed	Trace.	1.45	.10

It is pointed out that the solvents used do not give exact results. A comparison of the above data with analyses of these substances shows that in general where the crude fiber is high the lignin is high also, and vice versa.

The author reports studies on the character of lignin. It was found that when the insoluble residue obtained above was extracted with dilute ammonia a brown coloration was produced and the residue then yielded cellulose with Schweizer's reagent. After treating a while longer more cellulose could be dissolved out with Schweizer's reagent, and this process could be repeated many times. A simple apparatus was devised for supplying fresh ammonia, so that the extraction could be carried on undisturbed for weeks, and even months. Various materials (feeding stuffs, wood, cork, etc.) digested in this apparatus, the time required for dissolving out the incrusting substances depending upon the degree of lignification. Finally the ammonia ceased to be colored, the residue looked like cellulose, and was for the most part dissolved by Schweizer's reagent. After no more cellulose could be obtained by the repeated digestion, there was still a small residue, consisting mostly of ash, but containing some organic matter. The ammonia extract containing the incrusting substances was evaporated. The sum of the cellulose, the ammonia extract, and the residue was very nearly equal to the amount of substance taken. The cellulose dissolved out in the above process contained varying quantities of pentosan, according to the nature of the material taken.

The ammonia extract from wood and cork was dark brown, gave an odor of vanilla on evaporation, and the dried residue was insoluble in water but soluble in ammonia and reprecipitated by acid. It is believed to belong with the humus acids and was not further studied. The lignin from less lignified materials was quite different. Here the extraction was more rapid and the cellulose residue was greater. In case of wheat bran silicic acid was recognized as the principal incrusting substance.

Aside from the humus acids another substance was regularly found, the occurrence of which has been previously noted by the author.

It has thus far been obtained only in amorphous form. Its elementary composition and general characteristics are given and further communications are promised.

The proteids of cows' milk, K. STORCH (*Monatshefte Chem., 18 (1897), pp. 244–281; Chem. Ztg., 21 (1897), No. 42, pp. 419, 420*).—The author reports studies on this subject, using sodium sulphate, magnesium sulphate, and common salt as precipitants. The fat was removed from milk by skimming after standing 24 hours, or by means of a separator. The skim milk mixed with 3 times its volume of a saturated solution of sodium sulphate and a little egg albumin, and heated to 100° is curdled. If the filtrate is neutralized with a saturated solution of sodium sulphate containing a very little acetic acid, and is then mixed with an excess of solid sodium sulphate, a precipitate *a* is obtained. The filtrate from this yields another precipitate *b* with strong acetic acid; and the filtrate from *b* contains no proteids. If, on the other hand, the skim milk is at once saturated with solid sodium phosphate without previous coagulation, *a* separates out as before, and the filtrate yields with acetic acid the precipitate *b*, but the filtrate from *b* is found to still contain a proteid which is believed to be the lactalbumin found by other authors. In the first method the lactalbumin (and lactoglobulin) is precipitated in the preliminary coagulation. The precipitates *a* and *b* both contain phosphorus. The substance is combined with calcium, is soluble in water, and is completely curdled by rennet; while *b* contains no lime, is insoluble in water, and is only slightly affected by rennet. The precipitates *a* and *b* can also be obtained with either magnesium sulphate or common salt. The amount of *a* obtained from 20 cc. of milk ranged from 0.47 to 0.56 gm., and of *b* from 0.05 to 0.08 gm. Acetic acid precipitates the larger part of *a* and *b* from diluted milk as caseinogen; the filtrate yields very little of *a* and *b* upon treatment with the above salts

The conclusions reached are (1) that the substances *a* and *b* are compounds of the original caseinogen; (2) that Hammarsteins' theory that there is only one caseinogen in cow's milk is corroborated; (3) that by saturation with sodium sulphate, magnesium sulphate, or common salt the caseinogen is not precipitated in its original form, but is decomposed into the two substances *a* and *b;* and (4) that the caseinogen is precipitated unchanged by acetic acid, and possibly also by saturating with two of the above salts simultaneously.

Method of drying sensitive organic substances, C. C. PARSONS (*Jour. Amer. Chem. Soc.* [*London*], *19* (*1897*), *No. 5, pp. 388, 389*).—In making water determinations in organic substances like soap, wood paper pulp, etc., the author proposes to expel the moisture by heating the substance immersed in paraffin oil. A "straight" paraffin oil is used which is prepared by heating to about 250° C. for some time and then kept in a closed vessel, as it absorbs moisture from the air when exposed. In making the moisture test a quantity of oil equal to about six times the weight of the substance is first heated in a drying oven at 240° C. It is then weighed, the weighed substance in a finely divided condition is placed in the oil, and the whole heated in the drying oven at 240° for a few minutes after the effervescence has ceased. Ordinarily the whole operation may be completed in 20 minutes.

"The advantages of this process are the quickness with which the operation may be carried out, simplicity of apparatus, ease of manipulation, and the fact that the substance to be dried is perfectly protected from any action of the air by being immersed in a neutral liquid while heated, so that it will stand a higher temperature without decomposition, insuring perfect dryness, than would be possible if exposed to the air."

On the determination of potash in Stassfurt salts, C. E. EGGERTZ and L. F. NILSON (*K. landt. Akad. Handl., 35* (*1896*), *pp. 326–356*).—Atterberg[1] found considerable discrepancies in the results of potash determinations in potash salts by the official Swedish method[2] and the Stassfurt method,[3] the former giving results in one instance 1.8 per cent lower than the latter in a series of analyses of kainit, and 2.3 per cent lower results in case of double manure salt. The authors made a comparative study of the two methods and subjected them to a critical examination. The average results obtained were as below:

Percentage of potash in Stassfurt salts.

	Kainit.			Double manure salt.			
	No. 3.	No. 4.	No. 6.	No. 1.	No. 2.	No. 5.	No. 7.
Official Swedish method	11.62	13.31	12.24	13.93	14.28	16.39	16.46
Stassfurt method	11.57	13.24	12.30	14.08	14.38	16.11	16.62
Difference	—.05	—.07	+.06	+.15	+.10	—.28	+.16

The sources of errors in determining potash in Stassfurt salts are considered in detail and at considerable length in the paper. The official Swedish method for the determination of potash in fertilizers is as

[1] Chem. Ztg., 24 (1896), p. 131 (E. S. R., 8, p. 24).
[2] Bihang. Svensk. Förf.-Samling, 1895, No. 31.

follows: Ten grams of the sample is transferred to a liter flask and 300 cc. of water, acidulated with 1 cc. dilute hydrochloric acid, added. The contents are heated nearly to the boiling point, and after thorough stirring, a very dilute solution of barium chlorid is added in an exceedingly fine stream, until all sulphuric acid is precipitated, and only a trace of barium chlorid is found in excess. After cooling, the flask is filled to the mark, and the contents mixed. Fifty cubic centimeters of the clear solution is then measured into a porcelain or platinum dish, and 10 cc. of platinum chlorid solution (equivalent to 1 gm. platinum) is added. The liquid is evaporated on a water bath to a thin sirupy consistency, taking care that the precipitate does not stick on the sides of the dish. Ninety per cent alcohol is now added, and the dish left standing until the potassium-platinum chlorid crystallized out has settled well. The liquid is filtered with suction through a weighed asbestus filtering tube, and the chlorid washed repeatedly with small quantities of alcohol which are decanted on the filter. The washing is continued until the alcohol is colorless, and the chlorid then transferred to the filtering tube by means of alcohol, washed with ether, dried at 130° C., and weighed.—F. W. WOLL.

The separate determination of total alumina and total iron oxid in phosphates, F. LICHTSCHLAG (*Chem. Ztg., 21 (1897), No. 28, pp. 264, 265*).—The method depends on the solubility of the aluminum phosphate in caustic soda solution. Two grams of the pulverized phosphate is fused in a platinum crucible with about 8 gm. of sodium carbonate. After complete fusion the mass is digested with hydrochloric acid at 50 to 60° C. until dissolved, then neutralized with strong sodium hydrate, heated almost to boiling, when 30 cc. of the 20 per cent sodium hydrate is added, and the contents violently stirred and digested for 15 minutes. After cooling and making up to 200 cc., 50 cc. is filtered off for the determination of alumina.

The precipitate on the filter, as it contains a part of the iron oxid, is washed back into the flask with hydrochloric acid and the total iron oxid in the flask, after reduction with zinc, is determined by titration with potassium permanganate.

The 50 cc. reserved for the determination of alumina, after acidulation with hydrochloric acid, is evaporated to dryness in a dish, taken up again with hydrochloric acid, and after adding hot water, is filtered into a beaker. It is now heated to boiling, made slightly alkaline with ammonia, and after allowing the precipitate to subside, filtered, and washed free from chlorids with hot water. The precipitate is ignited and weighed as $AlPO_4$. To insure a sufficiency of phosphoric acid for the alumina, it is advisable to add a few drops of sodium phosphate solution before precipitation with ammonia.—J. T. ANDERSON.

A simple method for the determination of fat in separated cream, M. WEIBULL (*Chem. Ztg., 21 (1897), No. 34, pp. 333–335*).—The total solids of the cream are determined in the usual way and the content of fat calculated by means of the following formula: $t=f+\frac{100-f}{100}\times$ constant, in which t=total solids, f=fat, and "constant"=per cent of fat-free solids. The latter is found to be practically constant, varying slightly for different breeds of cows. From the analysis of 20 samples of cream the author found this factor to be 8.7.

The above formula is easily understood when it is remembered that the fat-free solids in ordinary milk and cream decrease in the same ratio that the fat increases.—J. T. ANDERSON.

The constitution of tannic acid, H. SCHIFF (*Gaz. chim. Ital., 27 (1897), No. 1, p. 90; abs. in Chem. Centbl., 1897, I, No. 8, p. 411*).

Contributions to the birotation of dextrose, H. TREY (*Ztschr. physikal. Chem., 22 (1897), No. 3, p. 424*).

Remarks on the structure of formose, O. LOEW (*Chem. Ztg., 21 (1897), No. 26, p. 242*).—The author attempted to decide whether the condensation product of formic aldehyde, formose, contains a normal chain. Hexite was formed by reduction with sodium amalgam and converted into the benzal compound. None of the tribenzal derivatives described by Fischer were produced, so that no normal chain can be present. The author gives the formula

$$\begin{matrix} CH_2\,OH \\ CH_2\,OH \end{matrix} > C(OH).\ \ CHOH.\ \ CO.\ \ CH_2OH.$$

based on previous investigations.—W. H. KRUG.

The copper reducing power and the density of solutions of dextrose, levulose, and invert sugar, H. T. BROWN, G. H. MORRIS, and J. H. MILLAR (*Jour. Chem. Soc. [London], 71 (1897), No. 412, p. 275*).

The experimental methods used in the examination of the products of the dialysis of starch by diastase, H. T. BROWN, G. H. MORRIS, and J. H. MILLAR (*Jour. Chem. Soc. [London], 71 (1897), p. 72; Chem. News, 75 (1897), No. 1939, p. 42*).

The relations between the specific rotatory power and the copper reduction of the products of the hydrolysis of starch by diastase, H. T. BROWN, G. H. MORRIS, and J. H. MILLAR (*Jour. Chem. Soc. [London], 71 (1897), p. 115; Chem. News, 75 (1897), No. 1939, p. 43*).—When starch is hydrolyzed by diastase, there is a constant relation between the specific rotation and the copper reduction of the products. Soluble starch has the reducing power 0, $(\alpha)_D = 202°$. The reducing power of maltose is placed at 100, $(\alpha)_D = 138°$. For every stage of the hydrolysis and every fraction of the products $(\alpha)^D = 202° - 6.64$ R.—W. H. KRUG.

The specific rotatory power of maltose and soluble starch, H. T. BROWN, G. H. MORRIS, and J. H. MILLAR (*Jour. Chem. Soc. [London], 71 (1897), No. 410, p. 109; Chem. News, 75 (1897), No. 1939, p. 43*).

The pentosan content of cotton, H. SURINGAR and B. TOLLENS (*Jour. Landw., 44 (1896), No. 4, p. 355*).—Four hundred grams of pure cotton was heated with 4 liters of 4 per cent sulphuric acid and a small quantity of sirup obtained which yielded crystals of dextrose. Only traces of furfurol were obtained on distillation with hydrochloric acid.—W. H. KRUG.

The pentosan content of various fodders and their fiber, F. DURING (*Jour. Landw., 45 (1897), No. 1, p. 79*).

The pentosan content of various materials which serve as fodders, B. TOLLENS and H. GLAUBITZ (*Jour. Landw., 45 (1897), No. 1, p. 97*).

The detection and quantitative determination of sucrose in wines, P. KULISCH (*Ztschr. angew. Chem., 1897, No. 7, p. 205*).

The determination of lactose in milk, H. D. RICHMOND and L. K. BOSELEY (*Analyst, 22 (1897), Apr., p. 98*).

Miscellaneous analyses, A. A. PERSONS (*Florida Sta. Rpt. 1896, pp. 61–64*).—Analyses with reference to fertilizing ingredients are given of coontie (*Zamia integrifolia*), saw palmetto (*Sabal serrulata*), sponge Florida rock phosphate, and 7 samples of muck.

Proceedings of the Thirteenth Annual Convention of the Association of Official Agricultural Chemists, H. W. WILEY (*U. S. Dept. Agr., Division of Chemistry Bul. 49, pp. 127*).—This is a detailed account of the proceedings of the convention held at Washington November 6, 7, 9, 1896. A brief account of this meeting has already been given in the Record (E. S. R., 8, p. 272).

BOTANY.

The decomposition of protein during germination, D. N. PRIANISHNIKOW (*Izv. Moskov. Selsk. Inst.* [*Ann. Agron. Inst. Moscou*], *1* (*1895*), *pp. 153–206*).—The author quotes the work of Boussingault, Pfeffer, Borodin, and others, and gives a summary of the present views regarding the function of asparagin in germination. He agrees with the theories advanced by Schulze rather than those of Pfeffer. Schulze's experiments (E. S. R., 7, p. 748) were made with lupines, which are rich in nitrogenous substances and poor in carbohydrates.

The author made experiments similar to those of Schulze with *Vicia sativa*, which contains a large amount of carbohydrates, *i. e.*, 40 per cent. Experiments were also made to determine whether regeneration of asparagin into protein is possible without the action of light when carbohydrates are supplied artificially, and to study the influence of calcium salts on the decomposition of protein in germination.

The results of the author's experiments are discussed at length. The principal conclusions reached were the following:

Asparagin is formed in germinating seeds without regard to the amount or kind of carbohydrates present. Supplying the germinating seed with carbohydrates by artificial means did not cause regeneration of asparagin to protein. The distribution of asparagin in the germinating plant is not such as would be expected if it were formed in the cotyledons and consumed at the point of growth. Hence it appears improbable that asparagin serves for the transportation and regeneration of protein, as Pfeffer teaches. In the author's opinion Boussingault's view is more in accordance with facts. He believed that asparagin is formed in the etiolated plant as a decomposition product in the same way that urea is formed in the animal organism. Nonnitrogenous substances are not without influence on the decomposition of protein in the plant. They retard it, as is the case in the animal organism.

The theory that carbohydrates are oxidation products of protein, in the author's opinion lacks proof. Calcium salts accelerate the decomposition of protein in germination. The protein in etiolated and normal plants contains practically the same nitrogenous compounds in different proportions.—P. FIREMAN.

Report of the botanist, P. H. MELL (*Alabama College Sta. Rpt. 1895, pp. 9–14*).—The additions made to the botanical department during the year in the way of instruments and the like are mentioned, and the seeds planted in the botanical garden during the season are enumerated by varieties. Seed of Ragi millet (*Eleusine corocana*), Kodo millet

(*Paspalum scrobiculatum*), new Japanese buckwheat, and of some of the best forms of cotton secured by crossing were distributed among the farmers of the State. A table gives results of the same varieties sent to the farmers when grown at the station.

Concerning the systematic botany and geographical distribution of the Pomaceæ, V. FOLGNER (*Inaug. Diss. Breslau, 1897, pp. 46*).

Concerning a new species of Micromycetes, F. TOGNINI (*Rend. Real. Inst. Lombard, 2. ser., 29 (1896), pp. 4; abs. in Bot. Centr. Bl., 70 (1897), No. 5, p. 168*).—*Acremoniella verrucosa* is described as a new species. It was found abundant on culms and sheaths of wheat and oats and is thought to be the cause of disease of those cereals.

Contributions to the knowledge of the genus Carex, G. KUKENTHAL (*Mitt. thuringer bot. Ver., n. ser., 10 (1897), pp. 34–41; abs. in Bot. Centbl., 70 (1897), No. 6–7, pp. 214, 215*).—Several new forms and hybrids are described.

A preliminary list of Alabama fungi, L. M. UNDERWOOD and F. S. EARLE (*Alabama College Sta. Bul. 80, pp. 113–283, XVII*).—An historical sketch of the study of fungi in Alabama and a list of works and papers treating of fungi occurring in the State precede the list of fungi. The list gives the fungus with its host plants and the county where the fungus was collected, the date of collection, and the name of the collector. Suggestions to collectors of fleshy fungi, a synopsis of the Agaricaceæ, and a host index are appended.

The preservation of fungi (*Ztschr. Nahr. Untersuch. u. Hyg., 11 (1897), No. 11, pp. 175, 176*).—A brief account of a method suggested by Tschirch.

Recent researches on the tubercles and nodules of leguminous plants and on their relations to the plants, C. NAUDIN (*Jour. Agr. Prat., 61 (1897), II, No. 27, pp. 46–51*).

Alinit, a new bacterial preparation said to enable cereals to use the nitrogen of the air (*Deut. landw. Presse, 24 (1897), No. 56, p. 516*).—A note concerning the discovery of the bacterium and the use and manufacture of the preparation.

On the decomposition of albuminoid substances and on the formation of asparagin and glutamin in germinating plants, E. SCHULZE (*Chem. Ztg., 21 (1897), No. 63, pp. 625–628*).

On the assimilative tissue of stems deprived of leaves, A. BOIRIVANT (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 6, pp. 368–370*).

The physiology of phosphorescence, F. KUTSCHER (*Ztschr. physiol. Chem., 23, No. 2, pp. 109–114, pl. 1*).—The author describes the fungus causing phosphorescence on wood.

On the bulbs of orchids, LECLERC DU SABLON (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 2, pp. 134–136*).

On the replacement of the principal root by a radicle among dicotyledons, A. BOIRIVANT (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 2, pp. 136–139*).

Nitrogen and forest vegetation, L. GRANDEAU (*Jour. Agr. Prat., 61 (1897), II, No. 37, pp. 411, 412*).

Variations of the lower fungi under the influence of media, J. RAY (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 3, pp. 193, 194*).

FERMENTATION—BACTERIOLOGY.

An aërobic denitrifier in the germination of seeds, M. EGUNOV (*Zap. Novo-Alexandri Inst. Selsk. Khoz. Lyesov.* [*Mem. Inst. Agron. et For. Nowo-Alexandria*], *9 (1895), pp. 25–39*).—Bréal[1] has reported studies on the reduction of nitrates in the germination of seeds, reach-

[1] Ann. Agron., 19 (1893), p. 275.

ing the conclusion that this reduction is due to an aërobic ferment brought in with the seeds, which develops at the expense of the organic matter extracted from the seeds by the water used. These reducing agents not only utilize the oxygen dissolved in the water, but also that of the nitric acid.

In continuation and extension of the work of Bréal, the author undertook (1) to determine whether nitrates are reduced under free access of air and to what form are they finally reduced, and (2) to isolate the ferment from the plant and study it in pure cultures. The results obtained were as follows:

(1) The reduction of the nitrates in the germination of seeds (Gramineæ, Cruciferæ, and Leguminosæ) to nitrous acid and ammonia is due to microörganisms.

(2) A denitrifying aërobic microörganism is associated with the seeds and lives at the expense of the water-soluble substances of the seed coat and the chaff.

(3) This aërobic microörganism can be isolated by the ordinary bacteriological methods and occurs in fresh cultures almost exclusively in the form of a Diplo bacillus, very quick in its movements, and quickly liquefying gelatin in plate cultures.

(4) In artificial cultures it may live in the presence of only dextrose and nitrates (besides inorganic salts), although an addition of a small quantity of nitrogenous substances (bouillon) is very favorable to its growth.

(5) The reduction of nitrates in artificial media is so rapid that it can only be explained on bacteriological grounds.

(6) The reduction of nitric acid in pure cultures of the organism passes through the nitrous acid stage, but continues until free nitrogen is formed.

(7) That the organism is aërobic is proved very clearly by its growth in various nutritive media and by its feeble growth in the absence of oxygen.

(8) On gelatin with nitrates it grows for a long time without liquefying. Liquefaction takes place after 20 days, beginning from the top and slowly proceeding into the depth of the media. This peculiar growth gives reason to suppose that denitrification is a chemical process.

(9) A complete account of the products of the life activity of the bacillus is impossible as yet.—P. FIREMAN.

Bacteria of horse manure and their physiological rôle in the decomposition of the manure, SEVERIN (*Trudi Imp. Voln. Econ. Obshch. Akklim. Zhivotnikh i Rastenii, 5 (1895), pp.—*).—The author succeeded in separating 26 species of bacteria from manure, of which 24 were aërobic and 2 anaërobic. Of the latter one proved to be a microörganism capable of producing tetanus. Parallel experiments were carried out on the decomposition of manure, on the one hand, without the participation of microörganisms under the influence of air alone, and on the other hand, with the participation of microörganisms. The results indicate that the decomposition of the manure was almost exclusively due to the activity of the bacteria, and in but an insignificant degree to direct oxidation. Artificial elevation of the temperature to 50 to 56° C., while intensifying the purely chemical process of oxidation of the manure three and a half times, greatly depressed the life activity of the microörganisms, and thus weakened oxidation due to their action seven and a half times. In all these experiments mixtures of 3 kinds of bacteria were used. Each culture when used separately exhibited considerably less oxidizing power than the mixture of the three.—P. FIREMAN.

Contribution to the knowledge of anaërobiosis, N. CHUDIAKOW (*Izv. Moskov. Selsk. Inst.* [*Ann. Agron. Inst. Moscou*], *2* (*1896*), *pp. 1–116*).—From the results of an extensive experimental investigation on this subject the author arrived at the following conclusions: Oxygen exerts a decidedly germicidal effect on the anaërobic bacteria only under the condition of relatively protracted action. If the action is not protracted fermentation is checked, but none except the weaker organisms are killed. In none of the media used did the anaërobic bacteria develop with an unlimited excess of air. In media containing not more than 0.5 per cent of oxygen the anaërobic bacteria may absorb oxygen in the process of respiration without injury. By successive cultures with gradually increasing amounts of oxygen purely anaërobic bacteria may be so modified that they can thrive in atmospheres containing amounts of oxygen which would originally have proved fatal. Aërobic and anaërobic bacteria may simultaneously exist under an atmospheric pressure of 5 to 10 mm.—P. FIREMAN.

Bacteria in soil, air, and water at Ultuna, Sweden, A. LAGERVALL (*Rpt. Ultuna Agr. Inst. 1895, Falun, 1896, pp. 40–48*).

On the oxidizing action of manganese salts and on the chemical composition of oxydases, G. BERTRAND (*Compt. Rend. Acad. Sci. Paris, 124* (*1897*), *No. 24, pp. 1355–1358*).

Bactericidal action of tannin, G. GOEGG (*Ann. Microgr., 9* (*1897*), *pp. 49–144; abs. in Jour. Roy. Micros. Soc.* [*London*], *1897, No. 3, p. 239*).—*Bacillus anthracis, B. pyocyaneus, B. coli communis, B. prodigosus,* and *Staphylococcus aureus* were studied in connection with different strengths of the tannins, aspidospertannic, coffee-tannic, catechu tannic, kino-tannic, gallic, rhatany-tannic, and tannic acids. Aspidospertannic acid is more bactericidal than officinal tannin, and explains the remarkable tanning properties of *Quebracho colorado* from which it is obtained. Kino-tannic acid is more powerful than the kinos themselves. *Bacillus pyocyaneus* and *Staphylococcus pyogenes aureus* are killed by rhatany-tannic acid. Spore-forming bacteria are little affected by tannin.

ZOÖLOGY.

The birds of Colorado, W. W. COOKE (*Colorado Sta. Bul. 37, pp. 3–143*).—After a brief introduction, in which it is stated that the number of species and varieties of birds known to occur in Colorado is 360, of which 228 breed there; that the basis of the avifauna of the State is formed by the species which range over the whole of the United States and of those that are most abundant in the middle west; and that to these are added the distinctively eastern species, such as the bobolink, phœbe, bluebird, and Baltimore oriole; the western species, the dwarf hermit thrush, Grace's warbler, golden-crowned sparrow, and the black swift; the northern forms, the Holbœll grebe, arctic tern, harlequin duck, Barrow's golden eye, and some think more than 20 truly southern species occurring as stragglers; and that of accidental visitors noted there are 3 varieties of surf ducks and specimens of the English *Saxicola œnanthe*, Bendire's thrasher, an olivaceous flycatcher, a white-winged dove, a white ibis, a roseate spoonbill, and a scarlet ibis; and, after a few remarks on the geographical and meteorological features of the State, on the ornithological work previously done there, etc., a classified list of the birds of the State is given; then another showing dates of arrival, etc.; a bibliography of Colorado ornithology is given and a history of Colorado ornithology briefly discussed, and finally a systematic annotated list of the birds of the State is given. Following all is a comprehensive index.

Economic ornithology: Birds in their relation to man, W. STONE (*Scient. Amer. Suppl., 43 (1897), No. 1116, pp. 17835, 17836*).—This is condensed from a lecture delivered at the Philadelphia Academy of Science. The lecturer speaks of the benefits that man derives from birds, of birds as the farmer's friends and as his enemies, and of man's influence on bird life, and finally makes a plea for the protection of our feathered friends. He states that it has been calculated that there are from 700 to 1,000 birds to every square mile of rural district, and that, supposing each bird would eat 50 larvæ per day, the birds of Pennsylvania would consume 1,760,000,000 insects each day, or a number that might have eaten up 176,000 acres of grass.

Methods in economic ornithology, with special reference to the cat bird, S. D. JUDD (*Amer. Nat., 31 (1897), No. 365, pp. 392–397*).

Birds considered useful to agriculture and sylviculture and measures for their protection, S. LONGCHAMPS (*Rapports Preliminaires 3e Congrès Internat. d'Agr., Bruxelles, 1895, pp. 57–75*).—The insectivorous birds are listed, and a brief bibliography of works relating to useful and injurious animals in Belgium is given.

Insectivorous birds of New South Wales (*Agr. Gaz. New South Wales, 8 (1897), No. 1, pp. 25–37*).

Food of woodpeckers and flycatchers, A. J. COOK (*Auk, 13 (1896), pp. 85, 86*).

Feeding habits of the English sparrow and crow, S. D. JUDD (*Auk, 13 (1896), pp. 285–289*).

The common lapwing plover or peewit (*Jour. Bd. Agr. [London], 4 (1897), No. 1, pp. 11–13, fig. 1*).—It is stated that no other bird is so beneficial to cultivators as the common lapwing (*Vanellus cristatus vulgaris*).

Titmice (Paridæ) (*Jour. Bd. Agr. [London], 4 (1897), No. 1, pp. 27–32, figs. 2*).—A popular brief account of the crested titmouse (*Parus cristatus*), coal titmouse (*P. ater*), marsh titmouse (*P. palustris*), great titmouse (*P. major*), blue titmouse (*P. cœruleus*), and long-tailed titmouse (*P. caudatus*).

Structure of the cutaneous glands of the larvæ of Ocneria dispar, N. M. KOULAGUINE (*Ann. Agron. Inst. Moscou, 3 (1897), No. 1, pp. 12–18, pl. 1*).—In Russian; French résumé. The cutaneous glands of the ninth to the tenth segment are described in detail. Each gland is only a gigantic cell with a ramified nucleus. Their conduits are clothed internally with a chitinous layer.

How the common garden snail is spread about, W. S. CAMPBELL (*Agr. Gaz. New South Wales, 8 (1897), No. 2, p. 115*).

METEOROLOGY.

Meteorological observations at the botanic gardens of British Guiana (*Rpt. Agl. Work Botanic Gardens, 1893–'95, pp. 2–9*).—Data are given for observations on rainfall, sunshine, and composition of rain for 3 years (1893–'95), and for comparison the rainfall during each month for 16 years (1880–'95) is tabulated. The principal data are summarized in the following table:

Meteorological summary.

	1893.	1894.	1895.
Total rainfall (in.)	135.240	85.350	82.560
Mean monthly (in.)	11.270	7.110	6.880
Chlorin in rain water (mg. per liter)	3.154	3.016	4.187
Nitrogen as ammonia in rain water (mg. per liter)	.068	.045	.065
Nitrogen as nitrates in rain water (mg. per liter)	.066	.041	.237

The 5 years ending with 1893 was a period of excessive rainfall, the annual precipitation varying from 109.66 in. to 135.34 in. (1893). In 1894 the rainfall dropped to 85.35 in., which represents more nearly the normal precipitation of the region. The amount of nitrogen carried down in the rain water varied from 1.63 lbs. per acre in 1894 to 5.59 lbs. in 1895. The data reported show that the seasons during this period (1893–'95) were very unfavorable to field experiments.

The results of meteorological observations in Mandchouria and surrounding regions, M. VENUKOFF (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 24, pp. 1402–1404*).—Mandchouria is comprised within the same limits of latitude as France, but it has a climate more like that of Finland and the Baltic Provinces of Russia. In fact, the winters are colder than those of these regions, although the summers are sufficiently warm to ripen the grape, which can not be grown on the shores of the Baltic. In July the isothermal line, 24° C., passes through Perpignan in France, 44° latitude, and through Bédouné in Mandchouria, 45° latitude. There is considerable rainfall both in summer and winter. On account of the influence of the Japan Sea the rainfall is largest in the eastern half of the country. In winter the prevailing direction of the wind is from the Northwest, in summer from the South and the South-Southeast. In the former case the wind is cold and dry, in the latter hot and moist.

WATER—SOILS.

On the composition of drainage waters, P. P. DEHÉRAIN (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 4, pp. 209–213*).—The results of examinations of the drainage water from the vegetation boxes at the Grignon station during two years are summarized as follows: The amount of nitric nitrogen in unfertilized fallow soil was found during wet years to be as high as 200 kg. per hectare (180 lbs. per acre), representing 1,250 kg. of nitrate of soda and exceeding the requirements of the most exhausting crops. Soils bearing crops produced a much smaller quantity of nitrates, because the rapid evaporation from the plants dried out the soil so completely that there was not sufficient moisture for active nitrification. When rain was very abundant, however, such soils even without fertilizer produced good crops, which contained more nitrogen than was found to be nitrified in the fallow soils.

The experiments show that although a large proportion of the nitrogen of soils is in an inert form, the nitric ferments are capable, if assisted by sufficient moisture, of converting this inert nitrogen into available form with sufficient rapidity to supply the demands of the largest crops.

Variations in the temperature at the surface of soils of different character, J. JOUBERT (*Compt. Rend. Acad. Sci. Paris, 124* (*1897*), *No. 24, pp. 1405, 1406*).—Observations were made in the park of Montsouris on the temperature of the air above (1) the naked soil covered with river sand, (2) asphalted soil, (3) soil paved with wood, (4) soil paved with stones, and (5) sward. The annual averages were practically the same in each case. In summer the temperature above the wood pavement was greater than that above the sward, the mean difference for the months of June, July, and August being 1.4°. In winter, however, there was practically no difference, although snow remained much longer on the wood pavement than on the sward. The temperature above the asphalted soil was lower during the summer than that above the wood pavement, the average excess over that above the sward being only 1.2°. In winter, however, there was still an excess, amounting to about 0.1°. The temperature above the stone pavement and the bare soil was only 0.9° higher than that above the sward in summer, and the same was true for the stone pavement during the winter. The temperature above the naked soil in winter, however, was from 0.1 to 0.2° lower than that above the sward. In the fall the differences were very slight. In the spring the temperatures above all of the soils were from 0.5 to 0.6° lower than that above the sward. The smallest variations in temperature occurred during all seasons above the stone pavement; the greatest during the hot months above the wood pavement, and during the cold months above the asphalt. Occasionally toward the end of winter the naked soil showed the maximum variation. During all seasons the diurnal variation in temperature was greater above the sward than above the other soils, the difference being especially marked in the spring.

Soil investigations, J. E. PAYNE (*Colorado Sta. Rpt. 1896, pp. 182–184*).—A brief account is given of the digging of holes 3 ft. deep every 5 rods each way over a portion of the experimental grounds of the Rainbelt Substation for the purpose of observing the character and variations of the different types of soil. Microscopic and chemical examinations of samples of soil taken in this way have been begun and "it is hoped that before another crop is planted a part of the field may be examined more in detail so as to enable us to map the strata in sections showing their undulations."

An account is also given of observations by the method of Hilgard and Loughridge[1] on the capillary rise of water in columns of common mulatto sandy soil, black adobe, and "gopher clay," the last of these containing particles "so fine that they appeared as mere specks when examined with a microscope which magnifies 340 diameters." Tabular data show that at the end of 90 days the water had risen 63 in. in the gopher clay, 43 in. in the mulatto soil, and $37\frac{1}{4}$ in. in the adobe, and was still rising.

Subsoiling, N. E. HANSEN (*South Dakota Sta. Bul. 54, pp. 24*).—The experiences with subsoiling at several experiment stations in the Northwest and on a number of farms in South Dakota, Nebraska, and Minnesota are given. The subsoiling experiments being conducted at the station are as yet inconclusive.

Wheat and oats on subsoiled plats showed a greater resistance to hot winds, but lodged more readily in hot, sultry weather than the grain on unsubsoiled plats. In a potato and a corn experiment, the increase of yield of subsoiled plats over unsubsoiled plats was 25 per cent and 11 per cent, respectively. The rainfall during the season was adequate and none of the plats suffered greatly from drought, so that the exact benefits from subsoiling could not be determined.

An experiment with tomatoes was conducted as a variety test of early varieties and as a subsoiling test. In 9 cases out of 22, the tomatoes on subsoiled land were later than those on surface plowed land. In 6 cases they were earlier and in 7 cases no difference was perceptible. In 15 cases the yield was in favor of subsoiling, while in the other 7 the crop was larger from the unsubsoiled plats. Early Ruby was the most productive, both on subsoiled and unsubsoiled land. As other very early varieties, Earliest of All, Hubbard Early, and Bond Early Minnesota are mentioned.

The results of experiments with beans, ruta-bagas, carrots, and cabbages are given. The author suggests that further experiments are needed to determine the effects of subsoiling.

Water analyses, A. A. PERSONS (*Florida Sta. Rpt. 1896, pp. 68–74*).—Analyses with reference to sanitary condition are given of 15 samples of water, with directions for the interpretation of the results of analyses, and some suggestions regarding the locating of a well.

The fertility of soil in general and of Russian soils in particular, S. BOGDANOV (*Selsk. Khoz. Lyesov., 183 (1896), pp. 1073–1184*).

A treatise on rocks, rock-weathering, and soils, G. P. MERRILL (*New York: The Macmillan Co. London: Macmillan & Co. Ltd., 1897, XX, 411 pp., 25 pls., 42 figs.*).—"In the work here presented the writer has endeavored to bring together in systematic form the results of several years' study of the phenomena attendant upon rock degeneration and soil formation. Although beginning with a discussion of

[1] California Sta. Rpt. 1893–'94, p. 70 (E. S. R., 6, 790).

rocks and rock-forming minerals, the work must be considered in no sense a petrology as this word is commonly used. What is here given relative to the origin, structure, and composition of rock masses is regarded as an essential introduction to the chapters on rock-weathering."

The book is divided into five parts as follows: (1) The constituents, physical and chemical properties, and mode of occurrence of rocks; (2) kinds of rocks; (3) the weathering of rocks; (4) transportation and redeposition of rock débris, and (5) the "regolith." The plan of treatment is simple and natural, and leads the reader easily from a consideration of the original rocks through the various stages of their disintegration and decomposition, and the transportation of rock débris to the formation and characteristics of soils.

In the part dealing with weathering the action of the atmosphere, chemical action of water; the mechanical action of water and ice; and the action of plants and animals, including nitrifying organisms, are discussed in detail. A valuable feature of the work is a special chapter based largely upon original work by the author on the chemical and microscopical character of the material resulting from the weathering of rocks in place. This work is especially valuable in bringing out the changes in composition which the material of soils has undergone in the processes of weathering and leaching.

The most important chapter from the agricultural standpoint is that devoted to "regolith." This term is used to include not only the soil, subsoil, and residual products of decomposition, but also the alluvial, æolian, and glacial deposits. The petrographical characters and conditions of the formation of the various deposits included in the regolith are described and the chemical nature, mineral composition, physical condition, weight, kinds and classification, color, and age of soils are briefly discussed, as well as the effect of plant and animal life on soils.

It is believed that this work will prove of great value to agricultural students and investigators because it is both comprehensive and suggestive, and treats many phases of the subject of the origin, formation, and characteristics of soil, especially the character, processes, and results of weathering, which have heretofore been more or less neglected; and lays a solid foundation for special studies and treatises on the soil in its agricultural relations. For an interesting review of the work see *Nature, 56 (1897), No. 1440, pp. 97, 98.*

The cultivation of the soil, P. P. Dehérain (*Ann. Agron., 23 (1897), No. 5, pp. 216–229*).—Second paper.

The relation between the underground and the cultivated soil, A. Helland (*Tidsskr. norske Landbr., 4 (1897), pp. 145–161*).

On subsoil plowing, G. Grotenfelt (*Om Alfplöjning. Mustiala (Finland), 1895, pp. 10*).

FERTILIZERS.

Experiments with fertilizers (*Selsk. Khoz. Lyesov., 183 (1896), pp. 1229–1231*).—The object of these experiments was to determine the influence of lupines grown with artificial fertilizers and plowed under as green manure on the yield of wheat. The experiments were carried out on plats of 172¼ square yards each, tests of each fertilizer combination being made in duplicate. The fertilizers were applied in amounts furnishing 53 lbs. of potash, 35.5 of phosphoric acid, and 53 of nitrogen per acre. The lupines were planted May 5 and plowed under August 5. Wheat was sowed September 2. The quantity of green manure plowed under was determined by weighing the lupines (tops and roots) on a plat of the same size as those used in the experiments (172¼ square yards). The yield of green lupines varied from 34,974.65 lbs. to 38,529.39 lbs. per acre.

The yields of wheat straw on the different plats varied from 2,807.45 to 3,774.74 lbs. and the grain from 1,530.20 to 2,230.28 lbs. per acre. The average weight of a bushel of grain was 52 lbs. of 100 grains 3.8 gm.

The data reported show that the greatest yield of grain as well as straw was obtained where the wheat was sowed on the fallow ground manured with kainit, superphosphate, and nitrate of soda. The next highest yield was obtained on the plat receiving green manure in addition to superphosphate. Then follow in order the plats receiving (1) green manure and bone meal; (2) green manure, kainit, and Thomas slag; and (3) green manure with barnyard manure. The best grain was obtained from the plats without green manure, but with kainit, superphosphate, and nitrate of soda, and from the plats with green manure and barnyard manure.

From an economic standpoint the use of lupines as a green manure was profitable only in conjunction with superphospate and bone meal.

The experiment was repeated in 1894 with the result that the largest yield was again obtained from the fallow plat without green manure, but the second highest yield was obtained from the plat receiving green manure and barnyard manure, the plats with green manure and superphosphate and green manure and bone meal following in order. As in the previous year, only superphosphate and bone meal were profitable in connection with the green manure.—P. FIREMAN.

Experiments with mineral fertilizers, M. PODOBYED (*Selsk. Khoz. Lyesov., 182* (*1896*), *pp. 899–910*).—The experiments were carried out on the fields and meadows of the Goretski Experimental Farm in the years 1893, 1894, and 1895.

Gypsum, phospho-gypsum, and kainit were applied to clover and timothy in the early stages of growth. The experiment occupied four 2.7-acre plats, one of which received 135 lbs. gypsum per acre, one 135 lbs. phospho-gypsum per acre, and the other 160 lbs. kainit per acre, while the fourth plat was left unfertilized. These fertilizers produced a marked effect on the clover during the first and second seasons, but the effect during the second season was less marked than during the first. Kainit was most effective during the first year, followed by phospho-gypsum and gypsum in the order named; but during the second season phospho-gypsum was more effective than kainit and much more so than gypsum. There was little difference between the results of kainit and phospho-gypsum in the first year, but on the whole phospho-gypsum was the most profitable application.

In 1893, 1894, and 1895 one 1.35-acre plat of spring wheat, grown after clover, was fertilized with 535 lbs. per acre of phosphorite and another with 266 lbs. per acre of superphosphate. A check plat was left unmanured. The phosphorite improved only the quality of the grain, but when barley was grown on the plat the next year the quality was improved and the yield increased. The superphosphate produced a marked effect on the spring wheat, but its influence on the barley crop the next year was slight. Both applications proved unprofitable.

Steamed bone meal containing 4.5 per cent of nitrogen and 24 per cent of phosphoric acid, and bone meal deprived of organic matter, with 0.5 per cent of nitrogen and 35 per cent of phosphoric acid were applied to barley, the former in 1895 and the latter in 1894 and 1895. In each case 304 lbs. per acre of bone meal was applied to 1.35-acre plats. A check plat was left for comparison. The bone meal with 0.5 per cent of nitrogen had very little effect, only somewhat bettering the quality of the grain, while the meal with the larger nitrogen content increased the yield. The bone meal deprived of organic matter produced a favorable effect on the oat crop the following season. Neither fertilizer proved profitable. In 1894 and 1895, four $\frac{7}{10}$-acre plats of fallow ground growing a mixture of vetches and oats were manured with various fertilizers. The first plat received 16,000 lbs. of sheep manure per acre; the second 600 lbs. of phosphorite and 240 lbs. of kainit per acre; the third 8,000 lbs. of sheep manure, 300 lbs. phosphorite, and 120 lbs. kainit per acre, and the fourth 8,000 lbs. sheep manure and 300 lbs. phosphorite per acre. Phosphorite and kainit were least effective. The application of manure, phosporite, and kainit was most effective and proved most profitable. The results of the manure and phosphorite differed only slightly from the results of manure alone.

An experiment with manuring winter rye grown on "black fallow ground" was carried out in 1894–'95. All plats were 1.35 acres in size and had been in sheep pasture for 5 years previous. The first plat received 10,666 lbs. of manure per acre; the second 400 lbs. phosphorite per acre; and the third 5,333 lbs. manure and 200 lbs. phosphorite per acre; the fourth served as a check plat. The manure produced the greatest effect on the rye and the following oat crop, while phosphorite was least effective. The quality of the grain was somewhat better than that from the manured plat. The mixture of manure and phosphorite gave varying results, but in general it was more effective than manure alone. The application of phosphorite, though having less effect on the yield, was most profitable.—P. FIREMEN.

Kainit: Its importance and future in agriculture, L. CHERNYAEV (*Selsk. Khoz. Lyesov., 183 (1896), p. 1236*).—According to the author, the favorable influence of kainit on crops is not due entirely to its potash content, but chiefly to its hygroscopic properties, which are most evident in dry years, and which are due to the presence in it of chlorids (especially magnesium chlorid). The last-mentioned salt as well as the other chief constituents of kainit, viz, sodium chlorid and the sodium and magnesium sulphates, have been found by the author to be abundant in the Russian salt lakes, and he suggests that they could be profitably utilized in the manufacture of a substitute for kainit.—P. FIREMAN.

Green manuring (*Jour. Bd. Agr. [London], 4 (1897), No. 1, pp. 1–10*).—A résumé of experiments in this line of work by European investigators.

On the industrial utilization of peat marshes in Sweden, Denmark, Northern Germany, and Holland, A. DAL (*Tidsskr. norske Landbr., 4 (1897), pp. 76–91*).

Calculation of the production of farm manure (*Norsk Landmansblade, 15 (1896), pp. 607–609*).

The rational feeding of crops, M. FISCHER (*Mitt. Oekonom Ges. Sachs., 1896–'97, pp. 65–90*).—The article treats of the use of fertilizers.

Commercial plant food, W. H. JORDAN (*Agr. Mass., 1896, pp. 53–90*).—This is a popular discussion of the purchase and use of commercial fertilizers with suggestions of means of securing greater economy in the use of such material. The desirability of uniformity in methods of inspection and simplicity in trade names is suggested. The farmer is also advised not to place any reliance in so-called special fertilizers, but to attempt to determine the needs of his crops and soils by experiment, and to buy unmixed fertilizing materials in large lots for cash. More complete utilization of farm sources of manure is strongly urged.

The influence of mineral salts in commercial fertilizers on the mechanical condition of the soil (*Braunschw. landw. Ztg., 65 (1897), No. 30, p. 136*).

Bone meal adulterated with sand, A. ATTERBERG (*Tidskr. Landtman, 17 (1896), pp. 665, 666*).

Field trials with artificial fertilizers, K. HANSEN (*Tidsskr. Landökon., 16 (1897), pp. 184–218*)

FIELD CROPS.

Field experiments with corn, oats, and forage plants, W. C. LATTA and W. B. ANDERSON (*Indiana Sta. Bul. 64, pp. 16*).—The results of experiments and variety tests with corn and oats are given in tabular form, together with descriptive notes and tabulated data on grasses and clovers.

A number of experiments in early and late planting of corn during periods of 5, 6, and 7 years indicated that the best results are to be obtained by planting between the 1st and 10th of May. The highest average for 11 years resulted from planting stalks 14 in. apart in the row. It was noticed in dry years that the yield of stover increased with thicker planting while the yields of grain decreased, yet on the whole a greater total yield of corn and stover was obtained from thicker planting.

Plats of drilled corn were cultivated 1, 2, and 3 in. deep for 6 consecutive years, and a plat cultivated 4 in. deep was added in 1894. The best average yield was in favor of cultivating 2 in. deep.

One series of plats produced corn, oats, and wheat continuously or in alternation with each other for 15 years; while an adjacent series produced those crops in rotation with timothy and clover during the same period. No manure was applied. In 1896 corn was grown on all these plats. The following table shows the results:

Yield per acre from rotation and all-grain cropping.

Plan of cropping.	Average of 9 years.	1896.
	Bushels.	*Bushels.*
Crops grown in rotation	33.46	54.08
Grain crops only grown	27.24	48.42
Gain from rotation	6.22	5.66

In one experiment corn was grown continuously on the same ground since 1880. In 1883 and 1884 a total of about 50 tons per acre of fresh horse manure was applied to certain plats, and no manure was used afterwards. During 12 years the manured plats averaged 9 bu. more corn per acre than the unmanured plats. On other plats where continuous culture was practiced horse manure produced a greater increase than a mixture of boneblack, sulphate of ammonia, and muriate of potash. Hill planting averaged a little greater yield than drill planting.

From a comparison of corn and Kafir corn, the author comes to the conclusion that "it is not at all probable that Kafir corn can take the place of common corn to any extent in this State."

A variety of oats named "Mortgage Lifter" produced the heaviest yield of grain, weighing $38\frac{2}{3}$ lbs. to the measured bushel. Red oats produced on one plat a higher yield than any recently introduced variety. Winter oats did not prove successful. Horse manure proved to be a better fertilizer for oats than a mixture of boneblack, sulphate of ammonia, and muriate of potash.

Hybrids from American and foreign cotton, P. H. MELL (*Alabama College Sta. Bul. 83, pp. 385–412, figs. 9, pls. 4*).—The author states the propositions to be considered in crossing varieties of cotton, the effects produced on cotton plants by transferring them to different climates and soils, and the requirements necessary to secure perfect results in hybridization. A list is given of the parents, and the botanical characteristics of American and foreign cottons are described and illustrated. The results of the work are given in tabular form. The author draws the following conclusions:

"The combination of the *Gossypium hirsutem* and *G. maritimum* yield a cotton plant which produces fiber of the best grade in strength, maturity, twist, length, fineness, and yield per acre.

"The blending of small and large boll species is not desirable, as a rule, because the resulting forms are generally weak and inferior.

"The *G. maritimum* is rather slow in maturing its bolls, and frost is apt to catch the plant in this climate before 60 per cent of the bolls are open. The hybrid procured by uniting *G. maritimum* and *G. hirsutem* is quicker in reaching maturity and is more prolific.

"The black, smooth seeds are generally transferred into furry seeds of a dark brown color.

"The Egyptian species are finer grades of cotton than those received from India, in length of strands, strength, and texture. They unite, also, more readily with the American species, and the hybrids are generally equal to the parents in qualities.

"The Sea Island cotton combines with the Afifi and Mannoah to produce superior grade of staple, and the plant is rather prolific. There is a prospect in the present stage of the experiments of securing a variety which will be a healthy, long staple, upland cotton."

Cotton culture in Egypt, G. P. FOADEN (*U. S. Dept. Agr., Office of Experiment Stations Bul. 42, pp. 5–28, figs. 1*).—The bulletin describes the conditions of cotton culture in Egypt and the methods of cultivation in use. The price of unginned cotton from 1888 to 1895, the average shade temperatures and the humidity of the air during different months, the soil temperature at different depths, the analysis of typical cotton soils and fertilizing constituents withdrawn from the soils, and the average rainfall at Cairo and Alexandria during each month are given in tabular form.

Particulars regarding 9 varieties of cotton most commonly grown in Egypt are given. The work of planting, irrigating, cultivation, and harvesting is described in detail. The cost of growing cotton in Egypt is estimated at $46 per acre and the returns from the crop at $66 per acre.

Potatoes, B. C. BUFFUM (*Wyoming Sta. Bul. 32, pp. 70, pls. 3*).—The experiments conducted at the station and the several substations comprise preparation of the soil for potatoes, methods of preparing seed, growing potatoes at different altitudes, and variety tests. Planting, cultivation, irrigation, cost and profit, and insect enemies and diseases are discussed in a popular manner.

At the Lander Substation, a bottom land plat yielded more than twice the crop of the same varieties grown on an upland plat.

Subsoiling for potatoes at three of the substations increased the yield 18.4, 18.5, and 21 per cent over unsubsoiled land.

A fertilizer experiment with bone meal spread over the seed in the furrow was inconclusive, as cold wet weather caused most of the seed to rot. It was found in these experiments that seed treated for scab with corrosive sublimate produced a good stand. Untreated seed planted with bone meal produced a partial stand, while untreated seed planted without bone meal failed to grow. It seems that corrosive sublimate effectually prevented wet rot of the seed, while bone meal was only partially effective.

Green manuring with peas resulted in an increase in yield of more than 38 per cent.

The yield from small potatoes planted whole was greater than from cuttings made of large potatoes, but the percentage of marketable tubers was less from the whole seed. "Cutting the potatoes in quarters lengthwise, so as to leave one-fourth of the seed end on each quarter, has been practiced at the home station for the past 3 years, and where the seed potatoes are not too large this method of cutting is recommended." The potatoes planted 8 in. apart in the row gave the best results.

The time between planting and harvesting the crop at the station and the several substations, although situated at different altitudes, was about the same in each experiment, and variations in yield did not correspond to variations in altitude.

The specific gravity and percentage of starch of varieties grown at Laramie and Sundance are given in a table. The average percentage of starch for all the varieties was 14.1 at Laramie and 17.3 at Sundance. "It is probable that the starch content of potatoes raised at high altitudes will be less than at low altitudes." The altitudes of Laramie and Sundance are 7,200 and 4,500 ft., respectively.

The results of variety tests at the station and substations are tabulated and a number of varieties are described in detail. The Blue Victor is the best keeper among the varieties tested. "In a cellar or pit where the conditions of temperature and ventilation are favorable this variety may readily be kept for more than one season."

Influence of artificial fertilizers on sugar beets, M. PODOBYED (*Selsk. Khoz. Lyesov., 183 (1896), pp. 327–332*).—Fertilizer experiments with nitrate of soda, superphosphates, and sulphate of potash on sugar beets were carried on in the Varsaw, Podolsk, and Petrokov Governments in Russia. The nitrate of soda increased the crop and the superphosphate the percentage of sugar. The best results were obtained by the joint action of these fertilizers. When the 3 fertilizers were applied together the productiveness was still further increased.

On the Derebchin Experimental Farm in the Podolsk Government a similar experiment was carried out by making a normal application of 160 lbs. of nitrate of soda, 330 lbs. superphosphate, and 30 lbs. sulphate of potash per acre to a number of plats, while another number received double the quantity of the same fertilizers. A number of check plats were not fertilized. The following results were obtained:

Results of experiments with fertilizers on sugar beets.

	Yield per acre.			Average weight of root.	Average weight of leaves.	Sugar content.	Coefficient of purity.
	Roots.	Leaves.	Sugar.				
	Pounds	*Pounds*	*Pounds*	*Grams.*	*Grams.*	*Per cent.*	*Per cent.*
No fertilizer	19,008	9,972	425	425	140	16.28	86.1
Normal quantity of fertilizer	26,244	14,778	2,880	433	215	15.84	84.2
Double normal quantity of fertilizer	28,728	18,648	2,966	460	300	15.04	83.0

—P. FIREMAN.

Experiments in the culture of the sugar beet in Washington for 1895 and 1896, E. FULMER (*Washington Sta. Bul. 26, pp. 36*).—This work is in continuation of that previously reported (E. S. R., 7, p. 762), which is summarized. Coöperative experiments in 1895 on acre and half-acre plats are reported from 10 localities in the State. Analyses of the soil, meteorological data, composition of the beets, and data relating to cost of production and yield are tabulated.

During 1896 experiments were made in growing beets from Washington-grown seed. Notes are given upon the crops raised from this seed under different conditions, the results being quite favorable.

The author concludes from the experiments of the two years that from 18 to 20 tons per acre of beets of excellent quality can be raised in the State at an expense of about $30 per acre.

Ten years of agricultural experiments at Cloches, C. V. GAROLA (*Dix années d'expériences agricole à Cloches, pp. 148, figs. 11, pls. 12. Chartres, 1896; abs. in Ann. Sci. Agron., 1897, I, No. 1, pp. 58–160*).—The effects of fertilizers consisting of a mixture of barnyard manure and commercial fertilizers, barnyard manure alone, complete fertilizers and fertilizers furnishing only two elements on crops of wheat, barley, oats, alfalfa, field and sugar beets, potatoes, and carrots were studied and the results tabulated. In nearly all cases the mixed fertilizers gave the best results. The soil was poor in phosphoric acid and hence in every case the absence of this element caused a greater reduction in the yield than the absence of either potash or nitrogen. In all experiments superphosphate gave better results than natural phosphate.

The largest crop of alfalfa was obtained from the application of barnyard manure. The fertilizers without nitrogen gave a better result than any of the complete fertilizers except barnyard manure.

In the experiments with sugar beets the complete fertilizer containing natural phosphate produced an excess of 8,832 kg. over the plat which received no manure, while the fertilizer containing superphosphate produced an excess of 18,590 kg. The author concludes that superphosphate is indispensable in sugar-beet production.

Report of the Rain Belt Substation (*Colorado Sta. Rpt. 1896, pp. 175–182; 184, 185*).—Notes are given on the crops of corn, sorghum, and small grain grown at the station during the year.

A study was made of the roots of Indian corn in different soils and at various stages of development. "Thirty days after planting roots were traced 2½ ft. deep and 3 ft. from the plant. Later some roots were traced 5 ft. deep and as far aside." In the black adobe soil the roots were located mostly in the upper foot of soil, while in the deep heavy clay soil they were found to grow down at a moderately sharp angle and the greater part of them to feed in the upper 2 ft. of soil.

Notes on wind-breaks and improvements made at the station are given.

Broom corn (*U. S. Dept. Agr., Office of Experiment Stations Circ. 28, pp. 4*).—Notes on varieties, culture, feeding value, and use.

Late sowing of carrots among spring and fall grains, SCHIEMER (*Braunschw. landw. Ztg., 65 (1897), No. 29, p. 132*).

Variety tests of cereals, clover, and grasses, 1889-'95, B. LARSEN (*Norsk Landmansblad, 15 (1896), pp. 577–579, 587, 588*).

Curing clover on racks, F. WAGNER (*Mitt. deut. landw. Gesell., 12 (1897), No. 12, pp. 160, 161*).—The article describes the use and the construction of the racks. Clover cured on racks had a higher feeding value than clover from the same field cured in the swath. The use of the racks is recommended during wet weather and in moist climates.

The cowpea (*Florida Farmer and Fruit Grower, n. ser., 9 (1897), No. 29, p. 450*).—A popular article on the culture of the cowpea and its relative value for feeding purposes.

Forage plants for South Dakota, E. C. CHILCOTT (*South Dakota Sta. Bul. 51, pp. 1–19*).—Attention is called to the importance of native forage plants, and the work conducted at the station is described. Kafir corn and Jerusalem corn did not mature seed, and in this respect were inferior to Indian corn. Besides these crops amber cane, brown durra corn, yellow millo maize, rape, oats and peas, sand vetches, rye, spurry, and millet were grown. Sachaline, cowpeas, soy beans, and flat or everlasting peas have given poor results and are considered failures. Sweet clover, serradella, sainfoin, and lupines were too coarse and woody to be of much value as hay.

Observations on several new forage plants, L. ROUGIER (*Prog. Agr. et Vit., 28 (1897), No. 30, pp. 102–106*).—Experiences with the cultivation of comfrey, flat pea, clover, sachaline, hairy vetch, and woad are given in a popular manner.

Report on test of varieties of grasses, C. S. CRANDALL (*Colorado Sta. Rpt. 1896, pp. 131–137, 163, 164*).—Plat cultures have been made of about 150 native and introduced species, and a detailed report is given on a number of species showing their adaptability to the climate and their value for pasture and hay.

The value of Lupinus perennis (*Deut. landw. Presse, 24 (1897), No. 59, p. 541*).—*Lupinus perennis* was sown under young evergreens, where it made an excellent growth and was beneficial to the trees. Notes concerning its use are given.

The hay harvest (*Ztschr. landw. Ver. Rheinpreussen, 14 (1897), No. 27, p. 243*).—A popular article on the methods of curing hay.

Hay making in France (*Farmers' Gaz., 56 (1897), No. 29, pp. 441, 442*).—A popular article on French methods of making hay.

The increase in yield of hops per acre during the last fifteen years (*Deut. landw. Presse, 24 (1897), No. 53, p. 488*).

Potatoes for profit, F. B. VAN ORNAM (*Ed. 3, Philadelphia: W. Atlee Burpee & Co., pp. 82, figs. 27*).

The oil content of German and Russian rape and turnip seed (*Deut. landw. Presse, 24 (1897), No. 59, p. 543*).—The average results of a number of analyses are given. German rape seed contained 47.5 per cent of oil and the Russian 44.6 per cent. The oil content of German turnip seed was 45.8 per cent and that of the Russian 41.3 per cent.

Sugar beets (*South Dakota Sta. Press Bul., p. 1*).—The necessary characteristics of sugar beets and directions for their culture are given.

Experiments on the influence of meteorological conditions on the ripening of sugar beets in the northern part of the Voronezh Government, D. BIRUKOV (*Selsk. Khoz. Lyesov., 182 (1896), pp. 641–649*).—The experiments described had for their objects (1) to ascertain the connection between the humidity of the soil and the quality of the beets (percentage of sugar) and (2) to determine the influence of early and late digging on the weight of the roots and sugar content.

On account of the impossibility of controlling the water conditions the experiments failed to show the connection between the humidity of the soil and the quality of the sugar beets.

Late digging caused loss in weight as well as in quality, the latter being affected to a greater extent than the former. Rain accompanied by a lowering of the temperature caused a decline in the quality, while a rise of temperature was followed by an improvement of the quality.—P. FIREMAN.

Directions for sugar-beet culture, J. H. SHEPARD (*South Dakota Sta. Special Bul., p. 1*).

Cultivation of sugar beets in Norway (*Norsk Landmansblad, 15 (1896), pp. 547, 548, 559–563, 571–574, 583–587*).

Sugar beet culture in Hungary (*Sächs. landw. Ztschr., 45 (1897), No. 27, p. 332*).—The acreage of beets for each year from 1887 to 1894 is given.

The beet-sugar industry in the United States (*Deut. landw. Presse, 24 (1897), No. 52, pp. 481*).—A description of the beet-sugar industry and its prospects for development.

Analyses of sugar-cane juice, A. A. PERSONS (*Florida Sta. Rpt. 1896, pp. 63, 64*).—Analyses are given of two samples of the juice of red sugar cane grown in Florida.

Tobacco (*Florida Farmer and Fruit Grower, n. ser., 9 (1897), No. 30, p. 468*).—Notes on curing, stripping, late planting, prevention of mold, and different methods of fighting worms.

Tobacco, O. COMES (*Del tabacco. Naples: Cooperativa Tipographica, 1897, pp. 133*).—History, statistics, pathology, culture, and geographical distribution of tobacco.

Report on tobacco experiments during 1893, O. COMES (*Relazione sulla coltivazione sperimentale dei tabacchi nel regno durante la campagna 1893. Naples: Cooperativa Tipographica, 1894, pp. 127*).

Argentina as a wheat producer (*Amer. Agr. (middle ed.), 60 (1897), No. 5, p. 99*).—A popular article on the amount and methods of wheat production in Argentina.

Ensilage, or the preservation of green fodder, A. C. McDONALD (*Cape Town: W. A. Richards & Sons, 1893, pp. 34, figs. 4*).

Crop notes, O. CLUTE (*Florida Sta. Rpt. 1896, pp. 7–12*).—Notes on Irish potatoes, sweet potatoes, corn, cassava, peanuts, chufas, taro, velvet bean, tropical yam, cañaigre, prickly comfrey, arrowroot, sachaline, ramie, beggar weed, flat pea, crimson clover, alfalfa, etc., grown at the station and the De Funiak Springs Substation during 1896.

HORTICULTURE.

Pot culture of lettuce, R. L. WATTS (*Tennessee Sta. Bul. Vol. X, No. 2, pp. 21–30, figs. 5*).—This is the report of an experiment to determine the best method of culture and marketing of forced lettuce to secure the highest price for the product.

In the latter part of August, seed of Grand Rapids lettuce was sown in shallow flats of fine rich sandy soil. The young plants were set in similar soil in 2 and 3 in. pots, and the pots were plunged close together in a bed of sand. In about a month they were transferred to permanent beds containing 8 in. of soil, 1 part sand, 1 part well-rotted manure, and 2 parts loam, to which was added a liberal amount of muriate of potash and dissolved rock phosphate. The pots were set about a foot apart each way and covered with ½ in. of soil. At intervals during growth each plant received ½ lb. sodium nitrate solution, made by adding 30 oz. of nitrate to 25 gal. water. A month in this bed was sufficient to mature the crop.

The use of pots was found to decrease the yield about 15 per cent. There was little difference in the yield of lettuce in 2-in. and 3-in. pots; 2-in. pots are recommended both for economy and convenience. The yield from subirrigated beds was no greater than from surface-irrigated beds, and there was no apparent difference in the quality of the lettuce grown by the 2 methods. The author favors the use of ground beds rather than benches. The best varieties of lettuce for forcing are noted and general hints on lettuce culture are given.

In marketing, some of the plants were slipped out of the pots and wrapped in oiled paper; others were left in the pots. The latter was the most successful method since the plants remained crisp longer.

Pot culture has the advantages of making it possible to retain the crisp condition of the lettuce for a considerable time, of increasing the attractiveness of the plants, of enabling both salesman and consumer to have a constant supply of fresh lettuce, of economizing space in temporary beds and time in permanent ones, and the like. Potted lettuce sells for fully one-third more than other lettuce on the Knoxville market. The disadvantages of pot culture are the expense of the pots and a slight increase of labor in marketing. If plants were sold by weight or measure, pot culture would also have the disadvantage of producing a smaller yield. The author believes that the advantages overbalance the disadvantages.

Experiment garden notes, I, W. B. ALWOOD (*Virginia Sta. Bul. 59, pp. 171–176*).—This is a popular bulletin compiled from notes taken on garden vegetables during several years.

General remarks are made on field culture of tomatoes and the methods used in forcing tomatoes are given. Out of 30 varieties of tomatoes tried under glass, Beauty is recommended as best. About 60 fruits per plant is the average yield. Some fruits weigh from 8 to 14 oz., but the average weight is below 8 oz. The author advises the use of ground beds rather than raised beds or boxes for forcing tomatoes. Pruning to a single stem and training upright to a wire trellis was found to be best of the methods tried. To test the necessity of artificial pollination, 40 blossoms before opening were covered with paper bags and these allowed to remain until the stigmas had passed the receptive stage. From the 40 blossoms 2 fruits set, but made little growth.

The culture methods best suited to celery are considered with some detail. For early use White Plume and for late Golden Heart and White Solid was found to be especially desirable.

Experiment garden notes, II, W. B. ALWOOD (*Virginia Sta. Bul. 60, pp. 3–14*).—A continuation of the work published in Bulletin 59 of the station. The culture and varieties of onions, early peas, snap beans, Lima beans, sugar corn, early salads, and asparagus are considered. The construction and management of hotbeds are given in detail.

Growing black-seed onions is not recommended, except where a good market can be had, on account of their poor keeping qualities. The potato onion is considered to be particularly adapted to the conditions in Virginia. The dwarf forms of peas were found to be no earlier than the medium forms and to yield less. Wrinkled peas were of better quality, but less hardy than smooth ones. Extra Early Valentine is highly recommended as the best variety of snap beans for home use. Henderson Dwarf Lima was found to be best of the Lima beans grown.

Report on garden vegetables and orchard and small fruits, P. K. BLINN (*Colorado Sta. Rpt. 1896, pp. 164–174*).—The author gives a report of the vegetables and fruits grown at the Arkansas Valley Substation, including variety tests of onions, cabbage, sweet corn, tomatoes, sweet potatoes, peanuts, celery, melons, sugar beets, and potatoes. The general condition of orchard and small fruits is mentioned, most of the fruts suffering from the effects of late frosts and high winds. Two unsuccessful attempts were made to establish strawberries. A report is also given of varieties of plums, apricots, peaches, quinces, pears, cherries, apples, nuts, blackberries, gooseberries, ornamental trees and shrubs, currants, and raspberries which were planted, and the number of living trees and shrubs are indicated.

Report of the horticulturist, C. S. CRANDALL (*Colorado Sta. Rpt. 1896, pp. 121–131*).—Tests of varieties of apples, pears, and plums are given, in which the different varieties are graded according to their being hardy, half hardy, or tender, on high and low lands.

Varieties of blackberries, raspberries, gooseberries, currants, and strawberries are also reported upon. The author reports having conducted some experiments with a view to the production of new varieties of strawberries, in which pollination was performed on 124 flowers, from which he obtained 88 perfect fruits and 21 imperfect ones. As a result of these crosses he has now growing about 500 seedling plants. He has also 39 seedlings derived from crosses effected in the greenhouse during the past winter.

The Jerusalem artichoke, H. L. DE VILMORIN (*Jour. Agr. Prat., 61 (1897), II, No. 31, pp. 201–203, pl. 1*).—A popular article on the history of the plant and its use and cultivation in France and Belgium. Four varieties are described.

Manuring asparagus, G. WYTHES (*Garden, 52, No. 1339, p. 45*).

Early celery, W. H. JENKINS (*Amer. Gard., 18 (1897), No. 136, p. 537*).—Notes on blanching and marketing early celery.

Mustard and cress for market (*Jour. Hort., 49 (1897), No. 2548, pp. 102, 103*).

Vegetable growing in the South for northern markets, P. H. ROLFS (*Richmond: Southern Planter Pub. Co., 1896, pp. 255, figs. 38*).—The book consists of revised lectures to classes in horticulture. It is designed to give concise directions for the preparation of soil, use of fertilizers, and planting and care of vegetables to obtain the earliest crops, and the best methods of packing for shipping, of raising seed, etc.

Success in vegetable growing in the South depends largely upon securing an early crop. The methods of culture calculated to increase earliness are therefore given a prominent place in the book. With the exceptions of alluvial lands, southern soils are poor in the elements of plant food and require correspondingly large applications of fertilizers, yet the fertilizers wasted in many cases destroy the profits. Throughout this book, therefore, especial attention is given to the preparation and use of fertilizers and the amounts required for different crops, a specific formula being given for each vegetable considered.

In the general discussion of fertilizers the author says: "The amount of any element in a special fertilizer is governed by the amount of that element removed from the soil by that particular crop." It may be fairly questioned whether this is in all cases entirely correct, because much plant food in addition to that removed with the crop, especially in the case of nitrogen, may be lost from the soil by leaching and through agencies of nitrification and denitrification, and also because the relative amounts of the various elements removed from the soil by a particular kind of plant may depend to some extent upon the relative abundance of those elements in the soil in which the plant is grown.

As a manual giving concise directions for the many operations connected with the production and marketing of vegetables the book will undoubtedly be found very useful to vegetable growers in the South.

Garden notes, J. H. SHEPARD and E. C. CHILCOTT (*South Dakota Sta. Bul. 52, pp. 23–31, pls. 3*).—Notes are given on a number of varieties of garden vegetables grown under irrigation.

Apple culture, F. F. BUTLER (*Agr. Gaz. Tasmania, 5 (1897), No. 1, pp. 11–13*).

Banana cultivation in Nicaragua, T. O'HARA (*U. S. Consular Rpts., 54 (1897), No. 203, pp. 556–563*).—The present status of the industry is noted and the question of profit discussed.

Improved varieties of oranges, G. E. WALSH (*Scient. Amer., 77 (1897), No. 4, p. 54; reprinted in Florida Agr., 24 (1897), No. 31, pp. 481, 482; and Florida Farmer and Fruit Grower, n. ser., 9 (1897), No. 32, pp. 498, 510*).

Race types of peaches (*Florida Farmer and Fruit Grower, n. ser., 9 (1897), No. 33, pp. 515, 516*).—From a paper by R. H. Price read before the Texas Horticultural Society.

The Japanese wineberry (*Gard. Illus., 19 (1897), No. 955, p. 235, fig. 1*).—The wineberry is recommended as an ornamental.

Pruning orchard trees, J. A. BALMER (*Washington Sta. Bul. 25, pp. 27, figs. 11*).—A popular discussion of the time, methods, and uses of pruning. Low heading is strongly recommended. For western Washington the author advises summer pruning to induce fruitfulness, and for the remainder of the State winter pruning to check the tendency to premature fruitfulness. A catalogue of the varieties of fruits growing at the station is appended.

Manual of practical orchard work at the Cape, P. MACOWAN and E. PILLANS (*Dept. Agr. Cape Good Hope, 1896, No. 4, pp. 110, figs. 9*).—The pamphlet discusses in a popular way the structure and functions of roots, soil constituents of plant food, mechanical condition of soil in relation to respiration of roots, cultivating and manuring orchards, planting and pruning trees, etc. The culture and varieties of the following fruits are considered: Apple, pear, quince, apricot, peach, plum, orange, lemon, citron, fig, walnut, and chestnut.

The principles of fruit growing, L. H. BAILEY (*New York: The Macmillan Co., 1897, pp. 508, figs. 114*).—This is the fifth book of the Rural Science Series. Its aim is to treat the fundamental principles and practices which apply to fruit growing in general, leaving to succeeding volumes such special problems as can be better treated in connection with particular fruits. The subject-matter is considered under the following heads: Introductory discussion, including an inventory of fruits, the geography of fruit growing, the course of evolution of a fruit region, and the outlook for fruit growing; the location and its climate, giving special prominence to frosts and means of protection from them, the effects of wind-breaks, etc.; the tillage of fruit lands; the fertility of fruit lands; the planting of fruit grounds; the secondary and incidental care of the fruit plantation; and diseases, insects, and spraying. An appendix containing a list of American books on general fruit growing is added.

Raspberry notes, C. C. NASH (*Amer. Gard., 18 (1897), No. 139, p. 584*).—Notes on 21 varieties.

Raspberries (*Garden, 52, No. 1343, pp. 128, 129, fig. 1*).—Notes on culture and varieties.

Strawberries, C. C. NASH (*Amer. Gard., 18 (1897), No. 134, p. 504, fig. 1*).—Notes on 20 varieties.

The forcing of strawberries, L. R. TAFT (*Amer. Agr. (mid. ed.), 60 (1897), No. 7, p. 147, fig. 1*).—A popular article, the data for which were obtained largely from Bulletin 134 of the New York Cornell Station.

The characters of some new hybrids, P. CASTEL (*Prog. Agr. et Vit., 27 (1897), Nos. 25, pp. 45–51; 26, pp. 770–777*).—A discussion is made of hybridizing grapes in order to secure stocks adapted to calcareous soils, to secure direct producers and to secure sorts resistant to black rot. Descriptive notes of a number of American species of grapes are given and their value for hybridizing discussed.

Grape culture in Uruguay, E. SCHRAMM (*U. S. Consular Rpts., 54 (1897), No. 203, pp. 574–577*).—A note is given on the extent of the industry. The acreage of grapes in each department of the government is given.

Premature consenescence of grapevines grafted on poorly adapted stocks, P. GERVIS (*Bul. Mens. Soc. Cent. Agr. Hort. et Accl., Nice, 37 (1897), No. 5, pp. 98–102*).

Test of fruits, C. S. CRANDALL (*Colorado Sta. Rpt. 1896, pp. 121–131*).—Lists of orchard and small fruits growing at the station are given, with notes on the conditions under which they are grown and their relative hardiness.

Fruit growing under glass (*Proc. New York Farmers, 1896–'97, pp. 5–28*).—Report of a discussion by members of the "New York Farmers" and others.

Report of the horticultural division of the Arkansas Valley Substation, P. K. BLINN (*Colorado Sta. Rpt. 1896, pp. 159–174*).—Brief notes are given on garden vegetables and orchard and small fruits. Lists of the fruits growing at the station are given.

Report on horticulture at the Rain Belt Substation, J. E. PAYNE (*Colorado Sta. Rpt. 1896, pp. 180, 181*).—A brief report is given of the condition of the orchard and other fruits as well as the garden vegetables. The results for this year are quite unsatisfactory on account of serious insect attacks and of heavy hailstorms nearly destroying all the plants.

Report of horticulturist, P. H. Rolfs (*Florida Sta. Rpt. 1896, pp. 21–34, 83–90*).—Brief notes are given on a large number of orchard and small fruits and vegetables. The orchard, experimental plats, and propagating house are described. Lists of the trees, shrubs, and other plants growing at the station and substations are given.

Some horticultural suggestions, F. S. Earle (*Alabama College Sta. Bul. 79, pp. 85–110*).—The bulletin treats in a popular way of the soils and fertilizers adapted to the various horticultural crops, irrigation, the construction and use of hotbeds and cold frames, transportation and marketing of produce, etc. General remarks are made upon the present status of commercial horticulture in Alabama and upon the risks to be encountered in that phase of the work. Growing fruits and vegetables for home use is also considered.

Horticulture during the queen's reign (*Jour. Hort., 49 (1897), No. 2543, pp. 566–578*).—A sketch of the progress of horticulture in England during the last 60 years. The advancement in floriculture, ornamental gardening, vegetable and fruit growing, hybridizing, etc., is outlined. The causes which have contributed to this progress are discussed. Brief notes are given on the work of the leading horticulturists of the period.

The production of blue flowers (*Wiener illus. Garten Ztg., 22 (1897), No. 7, pp. 210–213*).—The results obtained by H. Molish in experiments with *Hydrangea hortensis* are given (E. S. R., 8, p. 890). Alum, aluminum sulphate, and iron sulphate were found to induce the formation of blue flowers.

Culture of herbaceous caleolarias (*Jour. Hort., 49 (1897), No. 2548, pp. 93, 94*).

Carnations, A. Herrington (*Garden, 52, No. 1342, pp. 100, 101*).—A paper read before the Morris County (New Jersey) Horticultural Society. Propagation, classification, and history of carnations are dealt with.

New crinums, C. Sprenger (*Wiener illus. Garten Ztg., 22 (1897), No. 7, pp. 217–224*).

Autumn crocusses, S. Arnott (*Garden, 52, No. 1340, pp. 59, 60, fig. 1*).—Notes on culture and species.

Gladioli, J. Burrell (*Garden, 52, No. 1341, pp. 89, 90*).—Notes on soils, manures, culture, and varieties.

Kalmias, W. J. Bean (*Garden, 52, No. 1341, pp. 77, 78, fig. 1*).—Notes on culture, species, and varieties of Kalmias.

Lilacs (*Canadian Hort., 20 (1897), No. 7, pp. 273–276, figs. 5*).—Illustrated descriptive notes on a number of sorts.

Lily of the valley forcing, T. Jannoch (*Garden, 52, No. 1342, pp. 108, 109*).

Penstemon barbatus (*Meehan's Monthly, 7 (1897), No. 8, pp. 141, 142, pl. 1*).

Roses under glass (*Garden, 52, No. 1342, pp. 105, 106*).

The landscape gardener and his work, O. C. Simonds (*Garden, 52, No. 1338, pp. 27, 28; Gard. and Forest, 10 (1897), No. 491, pp. 282, 283; reprinted from Park and Cemetery*).

FORESTRY.

Forestry in South Dakota, L. C. Corbett (*South Dakota Sta. Bul. 53, pp. 32*).—This is a popular bulletin on the condition of forestry in the State. A list of questions concerning varieties of forest trees and their planting and cultivation was sent out by the horticultural department to the owners of the larger forestry plantations of the State, and the answers received are given in the bulletin. The native species are considered superior to introduced sorts. In most cases the ash is given first place, the elm second, and the box elder and soft maple are considered next in value. Nearly all answers favor the planting of seedling trees as against sowing the seed. The opinions as to cultivation vary and the author remarks that frequent shallow culture up to August 1 may be taken as a safe guide. A majority of the growers prune their trees to improve them in form. Cottonwood and box elder are found to be short lived in upland groves. A list of trees suited to each of the several sections of the State is given.

A study of the influence of groves and forest areas on the humidity of the air was made and the results are given in a table.

Average daily humidity in the forest and in the open.

Month.	Daily mean in forest.	Daily mean in open.	Mean difference.
	Per cent.	*Per cent.*	*Per cent.*
April	67.9	64.2	3.7
May	69.8	67.3	2.5
June	77.4	73.9	3.5
July	74.6	64.6	10.0
August	71.6	69.6	2.0
September	69.9	61.8	8.1
Average	71.9	66.9	5.0

Fraxinus eedenii, a new species of Javanese tree, J. G. Boerlage and S. H. Koorders (*Natur. Tijdschr. Neerl. Indië, 56 (1896), pp. 155–158; abs. in Bot. Centbl., 70 (1897), No. 5, pp. 162, 163*).

Pinus laricio in Corsica, M. L. Vilmorin (*Rev. Hort., 69 (1897), No. 15, pp. 354–358, figs. 2*).

Second-growth white pine in Pennsylvania, A. K. Mlodziansky (*Gard. and Forest, 10 (1897), No. 490, pp. 272, 273*).

Forest fires, N. I. Crahay (*Rapports Préliminaires 3e Congrès Internat. d'Agr., Bruxelles, 1895, pp. 311–326*).

Rôle of forests with special reference to the physical and economical conditions of a country and the necessity of forest extension, etc., E. Parisel and A. Lecart (*Rapports Préliminaires 3e Congrès Internat. d'Agr., Bruxelles, 1895, pp. 75–114*).

The care of weak limbs of trees, J. G. Jack (*Gard. and Forest, 10 (1897), No. 490, pp. 274–276, fig. 1*).—Bolts rather than bands are recommended for holding up broken or weak limbs of shade trees. The injurious effect of an iron band support is illustrated.

German woods, J. Simpson (*Garden., 52, No. 1343, pp. 116–118, figs. 3*).

DISEASES OF PLANTS.

The downy mildew of the cucumber; what it is and how to prevent it, F. C. Stewart (*New York State Sta. Bul. 119, pp. 154–182, pls. 4, figs. 2*).—It is estimated that in 1896 75 per cent of the cucumber pickle crop of southeastern New York was destroyed, probably 55 per cent of the injury being due to downy mildew alone and 20 per cent to all other causes. Notes are given on the injury done by the melon louse, boreal lady-bird, anthracnose, and the cucumber wilt disease. Of these the wilt disease was by far the most serious.

Downy mildew (*Plasmopara cubensis*) attacks the older leaves near the center of the vine and gradually spreads outward. Irregular yellow spots appear which in warm weather enlarge rapidly, the whole leaf soon turning yellow and drying up as if frosted. In cool weather the spots spread less rapidly, their centers becoming dry and of a light-brown color. Hot and moderately damp weather favors the growth of the fungus. It is usually most destructive in August. Only a few misshapen cucumbers are produced after it becomes fully established.

The structure of the cucumber leaf and of the mildew are popularly described and illustrated and the nature and life history of the fungus noted. The history of the disease is briefly given. The botanical relationship and the host plants of the fungus are also popularly discussed.

An experiment was conducted on $1\frac{3}{4}$ acres of cucumbers at Woodbury, New York, to test the value of Bordeaux mixture as a remedy for the mildew. Thirty rows of cucumbers were sprayed 7 times from July 13 to September 9, two sprayings being made with Bordeaux mixture of the 1:7 formula; 2 of the 1:11 formula; and 3 of the 1:8 formula. Ten rows were left unsprayed. Two rows in the midst of the unsprayed ones were sprayed 4 times from August 3 to September 9, one row with Bordeaux mixture of the 1:7 formula, and the other of the 1:11 formula. The spraying was done with a knapsack sprayer. A detailed chronological record of the experiment is given together with a diagram showing the arrangement of the different plats. Downy mildew was first observed August 7, about the time of the first picking. Less than a week later every hill of the unsprayed rows showed the disease, while only a few plants of the sprayed rows were affected. In two weeks from the time the disease appeared the unsprayed rows were yellow throughout and picking was practically finished, while the sprayed rows were green and produced a large number of cucumbers. From this time the disease gradually spread on the sprayed vines, though they continued to yield well until frost, a month after the unsprayed vines stopped yielding, producing in the month $260 worth of cucumbers. The cost of spraying, including the cost of material and labor, was but $14.31, or at the rate of $9.50 per acre. The author believes that if all the plants had been sprayed the results would have been even more marked, since the sprayed plants undoubtedly received infection continually from the unsprayed ones. Further experiments will be necessary to determine the strength of Bordeaux mixture to be used.

The bulletin also contains discussion of spraying muskmelons and watermelons and the chances of being poisoned by eating sprayed melons. Detailed directions are given for the preparation of Bordeaux mixture. A discussion is made of spraying machinery, a part of which is a reprint from Bulletin 75 of the station (E. S. R., 6, p. 833).

On the development of the white rot fungus of grapes, P. VIALA (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 2, pp. 105, 106*).—Notes are given on the life cycle of *Charrinia diplodiella,* which causes the so-called white rot of grapes. The fungus has been known in Europe since 1878, but only the pycnidial form of development had been observed. The author examined abundant material of *Vitis rupestris* and *V. riparia* from Hungary in 1896, and in addition to the pycnidia he claims to have observed the spermagonia, conidiophores, and perithecia. The pycnidia, spermagonia, and conidiophores were found upon the apparently vigorous shoots and the pycnidia appeared upon the dried branches in October and November.

Experiments were conducted in which the germination and growth of the different forms of reproduction were observed. It is claimed that while the black rot fungus does not attack the grapes after they have changed color, the white rot is very active upon them even after their maturity, seeming to indicate that the spores, etc., of *Charrinia diplodiella* will not germinate in acid media. This fact was also demonstrated experimentally, the sporidia germinating readily in slightly alkaline sugar solutions.

On the use of sulphate of iron for the destruction of the fungus parasites of the grape, G. CROQUEVIELLE (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 8, pp. 418, 419*).—The author reports favorably upon the use of sulphate of iron as a winter treatment for the prevention of black rot, oïdium, mildew, anthracnose, pourridie, etc., of the grape. The method of application recommended is to bathe or sprinkle the vines with a 10 per cent solution of sulphate of iron and place the powdered sulphate about the vines at the rate of 500 to 1,000 kg. per hectare, the quantity depending upon the porosity of the soil.

In another publication[1] the author recommends the application of powdered sulphate of iron and gypsum to vines where the other treatments have not been possible.

It is claimed this treatment is more efficient and cheaper than where copper sulphate is used in the same way.

Tomato blight, P. H. ROLFS (*Florida Sta. Rpt. 1896, pp. 37–48*).—A brief statement relative to the cause of the tomato blight and a list of plants attacked by the parasite is given. Among the plants which are liable to attack by this fungus are the tomato, pepper, eggplant, Irish potato, fig, sweet potato, morning glory, beet, peanut, beans, cowpeas, beggar weed, cabbage, summer squash, watermelons, English violets, chrysanthemums, etc. The characteristics of the attack on each of these plants are described at greater or less length.

It is stated that the tomato-blight fungus lives in the soil and attacks plants from this place; consequently any preventive means applied to the foliage would be almost entirely useless. The life history of this fungus, which is stated to be a form of Sclerotium, is more fully given in Bulletin 21 of this station (E. S. R., 5, p. 790), and it is suggested that spraying the ground with any of the standard fungicides for a distance of 6 in. or more about the stem of the plant would probably give partial relief.

[1] Rev. Hort., 69 (1897), No. 7, p. 147.

Experiments on the treatment of the potato rot, P. Boudrin (*Zap. Novo-Alexandri Inst. Selsk. Khoz. Lyesov.* [*Mem. Inst. Agron. et For. Nowo-Alexandria*], *9* (*1895*), *pp. 46–61*).—Experiments in the treatment of potato rot (*Phytophtora infestans*) with Bordeaux mixture are reported. The results indicate that the time of spraying should vary with the character of the season and the development of the potatoes. In wet years it should commence somewhat earlier than in dry years. The mixture should be applied before the leaves are visibly affected, since the treatment of the badly affected potatoes is likely to be injurious rather than beneficial. The spraying is the more beneficial the richer the soil, hence it is especially necessary where the fields are copiously manured.—P. FIREMAN.

Anthracnose of the bean, P. H. Rolfs (*Florida Sta. Rpt. 1896, pp. 48–49, figs. 2*).—Brief notes are given of this disease of beans, caused by *Colletotrichum lagenarium* and suggestions given for its prevention, through spraying of plants with Bordeaux mixture or some other fungicide. In case the Bordeaux mixture is used it should not be applied after the pods are well formed, but some such fungicide as eau celeste should be used.

Aphides and thrips as the cause of Bacteriosis of carnations, B. T. Galloway (*Florists' Exchange, 9* (*1897*), *No. 33, p. 732*).

A diseased appearance of cacti, P. Sorauer (*Monatsch. Kakteenkunde, 7* (*1897*), *No. 1; abs. in Bot. Centr. Bl., 70* (*1897*), *No. 6–7, p. 228*).—Notes are given of a peculiar swollen appearance of certain cacti. The condition is thought to be the result of local disturbance of the circulation of water in the plants.

Celery blight, P. H. Rolfs (*Florida Sta. Rpt. 1896, pp. 35–37*).—A description is given of the celery blight caused by *Cercospora apii* and the various conditions affecting the disease.

The downy mildew of the cucumber and its treatment, F. H. Hall (*New York State Sta. Bul. 119, popular ed., pp. 6, pls. 2*).—A popular summary of Bulletin 119 of the station.

Notes on some experiments on finger-and-toe (clubroot), M. C. Potter (*Jour. Newcastle Farmers' Club, 1896, pp. 5*).

Diseases and enemies of the grapevine in Algeria, E. Eich (*Rapports Préliminaires 3e Congrès Internat. d'Agr., Bruxelles, 1895, pp. 832–837*).

Notes on a disease of orchids, L. Mangin (*Rev. Hort., 69* (*1897*), *No. 15, pp. 346–349, figs. 6*).

Root galls of cultivated plants, B. D. Halsted (*Florists' Exchange, 9* (*1897*), *No. 34, pp. 754, 755; Amer. Florist, 13* (*1897*), *No. 481, pp. 74, 75; New England Florist, 3, No. 26, pp. 291, 292*).—Paper read at the meeting of the Society of American Florists.

On the presence of Pseudocommis vitis in the stem and leaves of Elodea canadensis, E. Rose (*Compt. Rend. Acad. Sci. Paris, 125* (*1897*), *No 6, pp. 362, 363*).—This myxomycete is shown to attack submerged plants as well as trees, etc. The plasmodia penetrate the epidermis of the plant and form longitudinal and transverse lines.

On the propagation of Pseudocommis vitis Debray, E. Roze (*Compt. Rend. Acad. Sci. Paris, 124* (*1897*), *No. 25, pp. 1470–1472*).

Diseases of plants, N. A. Cobb (*Agr. Gaz. New South Wales, 8* (*1897*), *No. 4, pp. 208–253, figs. 60*).

Letters on the diseases of plants, N. A. Cobb (*Agr. Gaz. New South Wales, 8* (*1897*), *No. 4, pp. 208–239, figs. 62*).—Popular summary of the diseases of field, garden, and orchard plants.

Methods of preventing smut in barley, G. GROTENFELT (*Tre metoder att fördrifva brandsvamp från korn. Mustiala, 1896, pp. 10*).—Gives results of culture trials with barley treated with (1) hot-water method, (2) Ceres powder, (3) carbon-bisulphid method. All the methods were effective in preventing smut; the yield was increased and the quality of the crop improved.

Spraying, F. C. SEARS (*Utah Sta. Bul. 49, pp. 26, figs. 12*).—This bulletin describes some of the more common fungus diseases and insect enemies of orchard fruits and suggests remedies for their prevention. Formulas are given for the preparation of various fungicides and insecticides, together with directions for their application. Several forms of spraying apparatus are figured and described.

ENTOMOLOGY.

The influence of environment on the life history of insects, J. B. SMITH (*Gard. and Forest, 10 (1897), No. 496, p. 334*).—The author points out that the old idea that when the life history of an insect is once worked out work on that insect is done, is coming to be regarded as erroneous, and that in the future it will be necessary to begin work afresh on the life history of insects, working with especial reference to the locality where the study is made. He notes the results obtained by Professor Card, of Nebraska, and Professor Washburn, of Oregon, and says:

"Mr. Card places much stress, and rightly, on the fact that in Nebraska apples blossom, set, and even close the calyx cup before the moths appear or the eggs are laid. In New Jersey this is not so. It is almost impossible to find an unhatched pupa in the orchard after the blossoms begin to drop. In our State there is nothing but larvæ to be found in the cocoons until the first spell of warm weather that starts the sap in the trees and induces a swelling of the buds. Then, almost over night, everything enters the pupal stage, and this is usually short, much less than the duration of blooming time in an apple orchard. But even in New Jersey differences exist. Near New Brunswick there is positively a single annual brood only. South of Burlington County there is at least a partial second brood, and the practice that would prove perfectly satisfactory in one locality would be distinctly imperfect in the other. The truth is that insects, like all other creatures, adapt themselves to their surroundings, and that their habits and life histories are different in even slightly different localities. I have never seen the egg of a codling moth on a leaf, and I believe none has been previously recorded. Nevertheless, I do not for a moment discredit Mr. Card's observation.

"We have a similar set of experiences with insecticides. Insects which succumb readily to kerosene in the Atlantic States defy it absolutely in Colorado, while we are just as likely to find the food plant much more sensitive to it. Washes that easily destroy the San José scale in California are ridiculously ineffective in the Atlantic States. This very scale is changing its life history and habits in the East materially in several directions. I will venture the prediction that in half a dozen years it will not be considered a first-class pest in New Jersey, though I would not like to extend this prophecy to localities with which I am less familiar."

The author is confident that when the subject is gone over from a local standpoint the practice of economic entomology will be greatly changed.

Insects affecting domestic animals, H. OSBORN (*U. S. Dept. Agr., Division of Entomology Bul. 5, n. ser., pp. 302, figs. 170*).—This is a comprehensive monograph of the insect and arachnid parasites of domestic animals based upon the author's own studies and those of others. The difficulty of accurately defining parasitism is referred to, and the plans followed by Lueckhart, Looss, Blanchard, Neumann, Railliet, and others in the discussion of the subject of parasitism are indicated.

The plan adopted by the author is to treat the different species in their zoölogical order so that related forms may be kept more or less together and repetition avoided, discussing each species as fully as may be, mentioning its past history, the extent of its injuries, its habits, its life history, and finally the proper methods of preventing or relieving its injuries. This plan is followed through six chapters, beginning with the Diptera and ending with the Linguatulina. The seventh chapter is devoted to preventive measures and discusses insecticidal substances, the methods of application of remedies, the direct capture or destruction of insects, the renovation of henhouses, and the subject of diminution by washes and dips. The eighth chapter gives a list of parasites classified according to their host, beginning with man, the apes, and the monkeys, and ending with pigeons, geese, and swans. A bibliography of about 123 titles constitutes the last chapter.

The introductory chapter discusses the grouping of the parasitic insects, the general life history of parasites, the origin of the parasitic habit, the results of parasitism upon the parasite, the distribution of parasites, the effect of parasites upon the host, the losses due to parasites, and popular notions concerning parasites.

Under the last head observations are reported which tend to show that the popular notions that poor and weak animals are more subject to attack of parasites than those in good condition and that white rather than dark cattle are infested are erroneous. The somewhat generally observed fact that mosquitoes, flies, lice, and other insects appear to select certain individuals in preference to others may be accounted for by a difference in the character of the secretions, in the structure of the skin, or in the size of the hair.

As in the case of other insects, it is usually much easier, the author states, to prevent injuries from parasites than to remedy them. Knowing that certain species are incapable of flight and must depend for their distribution upon the direct association of infested animals, the breeder may simply isolate his uninfested animals from his infested animals, or rub them with some substance obnoxious or destructive to the pests. This is obviously more simple than the employment of washes and dips to destroy parasites upon animals already infested.

Diptera (pp. 24–140).—The author discusses mosquitoes and gnats (Culicidæ), midges (Chironomidæ), flies (Simuliidæ, Tabanidæ, Leptidæ, Oestridæ, and Muscidæ), and forest flies and ticks (Hippoboscidæ and Nycteribiidæ). Considerable space is given to a discussion of buffalo gnats and botflies.

Siphonaptera; Fleas (pp. 141–155).—This includes descriptions of the jigger flea or chigoe (*Sarcopsylla penetrans*), the hen flea (*S. gallinacea*), opossum flea (*Pulex simulans*), house flea (*P. irritans*), bird flea (*P. avium*), the rat and mouse flea (*P. fasciatus*), the squirrel fleas (*P. sciurorum*, *P. howardi*, *P. wickhami*, *P. gillettei*, *P. coloradensis*, *P. hirsutus*, *P. longispinus*, and *P. montanus*), the spermophile flea (*P. bruneri*), the dog and cat flea (*P. serraticeps*), the rabbit fleas (*P. goniocephalus*, *P. gigas*, and *P. inæqualis*), the mole flea (*Typhlopsylla assimilis*), and the pocket gopher fleas (*Typhlopsylla americana* and *P. ignota*) are described.

Hemiptera (pp. 157–188).—The bedbug and its allies (Acanthidæ), the blood sucking cone nose (*Conorhinus sanguisuga*), and the numerous suctorial lice (Pediculidæ), are here brought together and described. The following new species are also described: *Hæmatopinus montanus*, *H. erraticus*, and *Euhæmatopinus abnormis*. In the case of the long nosed ox louse the name *H. vituli* Linn. is substituted for *Pediculus oxyrhynchus* and *P. tenuirostris* of Nitzsch and Burmeister, respectively.

Mallophaga (pp. 189–250).—The numerous bird lice (Philopteridæ and Liotheidæ) are treated here, and an appendix given in which the author lists the species of Mallophaga recognized as belonging to the fauna of the United States and describes several new species as follows: *Docophorus halieti*, taken from the bald eagle in Florida; *D. bubonis*, taken from the great horned owl (*Bubo virginianus*); *D. quiscali*, from the crow blackbird (*Agelaius phœniceus*), taken at Ames, Iowa; *D. sialii* and *D. agelaii*, from the bluebird (*Sialia sialis*); *D. corvi*, from the common crow (*Corvus americanus*); *D. minuto-trabeculatus*, from *Fulica americana; D. fusco-ventralis*, from the wood pewee (*Contopus virens*); *D. coccygi*, from a yellow billed cuckoo, taken at Lincoln, Nebraska.; *D. speotyti*, from the burrowing owl (*Speotyto cunicularia hypogæa*), taken at Lincoln, Nebraska; *Nirmus candidus xanthocephali*, from the yellow headed blackbird (*Xanthocephalus xanthocephalus*), taken at Fairfax, Iowa; *N. rotundatus*, from the crow, taken at Ames, Iowa; *N. picturatus*, from *Sturnella magna*, taken at Ames, Iowa; *N. pallidus*, from rose breasted grosbeak (*Habia ludoviciana*), taken at Ames, Iowa; *N. secundarius*, from the crow (*Corvus americanus*), taken at Ames, Iowa; *N. orpheus*, from *Galeoscoptes carolinensis; N. tyrannus*, from the kingbird; *N. marginatus*, from the woodpecker (*Ceophlœus pileatus*); *N. abruptus*, from *Colinus virginianus; N. parallelus*, from *Ægialitis vocifera; Lipeurus botauri*, from the bittern (*Botaurus lentiginosus*); *L. infuscatus*, from *Philohela minor* and *Bartramia longicauda; Trichodectes parallelus*, from the deer (probably *Cariacus virginianus*); *T. castoris*, from the beaver; *T. mephitidis*, from the polecat (*Spilogale interrupta*), collected at Tama Co., Iowa, and from skunks taken at Holt Co., Nebraska, and Palo Alto, California; *Menopon expansum*, found on *Dolichonyx oryzivorus; M. interruptus*, from *Corvus americanus; M. fusco-marginatus*, from *Turdus minor; Trinoton minor*, from the butter bill coot (*Oidemia*); *Physostomum lineatum*, from the humming bird (*Trochilus colubris*, Linn.).

Arachnida (pp. 251–275).—The harvest mites or chiggers (Trombidiidæ), the ticks (Gamasidæ), the mites (Ixodidæ), and the mites and scabs (Sarcoptidæ, Demodecidæ, and Linguatulina) are here brought together.

Remedies and preventive treatment (pp. 277–285).—The value of fish oil, tar, train oil, axle grease, pennyroyal, and dipping solutions is considered, along with other well-known insecticides. In the case of infested henhouses, the author thinks the best plan is to burn the structure if it is not of too great value. But where this course is impractical, and where the walls are tight enough to retain the fumes, fumigation with sulphur and drenching the roosts with kerosene or hot water and then whitewashing them are recommended, or covering the ends of the poles with tar may be practiced with success. The addition of carbolic acid at the rate of 4 oz. to a gallon of whitewash to increase the efficacy of the latter is recommended. Various methods of fumigation of animals placed in stalls or covered with blankets are brought out, and a plan for constructing a large dipping vat is described and figured.

The San José or pernicious scale, W. B. ALWOOD (*Virginia Sta. Bul. 62, pp. 31–44, figs. 5*).—A popular bulletin on *Aspidiotus perniciosus*, briefly recounting the introduction of the insect into the United States and its occurrence in Virginia and other parts of the East, with illustrated, descriptive, life history, and remedial notes. Besides the infested district at Charlottesville, where the species was first observed in 1893, the scale has been found in but one other locality in the State—a large orchard near City Point. Through lack of systematic treatment the scale has not been satisfactorily subjugated, and further infestation is anticipated. Directions are given for detecting the presence of the insect, and its great fecundity and numerous food plants are briefly mentioned.

The use of a winter wash of lye registering 5° Baumé and of soapsuds or kerosene emulsion as a summer wash is advised. The text of an act of the legislature giving the station power of inspection and treatment of the scale within the State is quoted.

Food plants of the San José scale in Ohio, exclusive of fruit trees, F. M. WEBSTER (*Canadian Ent., 29* (*1897*), *No. 7, p. 173*).—Besides the several varieties of roses, currants, raspberries, and gooseberries, *Aspidiotus perniciosus* has been found upon the following plants: Grape (*Vitis labrusca*), linden (*Tilia americana*), European linden (*T. europæa*), sumac (*Rhus glabra*), Japan quince (*Pyrus japonica*), cotoneaster (*Cotoneaster frigidum*), flowering peach (*Prunus* sp.), flowering cherry (*P.* sp.), American elm (*Ulmus americana*), black walnut (*Juglans nigra*), imported willow (*Salix verminalis*), cut-leafed birch (*Betula* sp.), lombardy poplar (*Populus dilatata*), Carolina poplar (*P. monilifera*), golden-leaf poplar (*P. van gerti*), catalpa (*C. speciosa*), chestnut (*Castanea sativa*), osage orange (*Maclura aurantiaca*), and snowball (*Viburnum opulus*). The cotoneaster, which was sent for inspection, was found literally covered with the scale.

Notes on the codling moth, F. W. CARD (*Gard. and Forest, 10* (*1897*), *493, pp. 302, 303*).—Failure in applications of the accepted doctrines in regard to this moth induced a thorough investigation of its life history. The results obtained were found to be very much at variance with the facts as given in entomological literature. Eggs were obtained in abundance.

"Instead of being laid in the calyx, we find that the eggs are laid almost exclusively on the upper surface of the leaves. Only rarely is one found on the apple or on the under side of the leaves, in the orchard, though in confinement they may be laid anywhere. At least this has been true up to this time. It may be, however, that the later eggs, when the apples are large, may be oftener found on the apple itself. They are usually found on leaves of a cluster associated with an apple. The egg is about the size of a pin-head and looks not unlike a small drop of milk. Apparently many sterile ones are laid, or the ovule perishes for some cause. These are whiter and more shining than the fertile ones. Just before hatching, a black spot develops in the center, which is the head of the young larva. When first hatched he is a tiny fellow about an eighth of an inch long, but as spry as a cricket. His head is then the most prominent part of him. He immediately begins to hunt for a hiding place, and the most convenient one is often that formed by the closed calyx cup, into which he enters to begin his work. About 80 per cent of the larvæ hatched in the orchard during the early part of the season have entered by that means. If two apples hang together or if a leaf hangs over one and close against it that appears to suit them just about as well."

Having learned its life history, the next question was to learn how to combat it. The best time for spraying seemed to be about a week or ten days after the trees were in full bloom, or, about May 15. Difficulty was found in drenching the calyx sufficiently and the spray was made coarser. But there were neither eggs nor larvæ at this time, the first eggs being found June 3 and the first larvæ on June 12, or nearly a month after it is necessary to spray in order to get the poison into the calyx cup. From this it is concluded that it is necessary to get the poison into the calyx cup so that the latter may close over it and retain it for the larvæ later on. This means would seemingly dispose of about 80 per cent of the larvæ. The remaining 20 per cent find ingress to the apples through the skin, and for them the author thinks an addition of soap, lime, or of Bordeaux mixture to a spray, making the latter stick better to the surface of the apples, will be found efficient.

The insects may be attacked in the egg stage—since the eggs are laid upon the upper surface of the leaf and are readily reached by kerosene emulsion. What strength of the emulsion will be efficient for fieldwork, however, has not yet been determined. The pupæ may possibly be successfully attacked by some caustic spray, and it seems as though the band and trap method might prove useful. In captivity the young larvæ eat the surfaces of the leaves, and if they do the same under natural conditions, it seems that they might be attacked by spraying the leaves.

The beet beetle and other enemies of sugar beets, A. SILANTYEV (*Selsk. Khoz. Lyesov., 183 (1896), pp. 1185–1200*).—A description of the ravages of the beet beetle (*Cleonis punctiventris*) upon beets in the Voronezh Government of Russia and methods of combating it. The usual methods employed there are hand picking and the formation of pitfall ditches about fields. The ditches, however, are found somewhat ineffective during the pairing time of the insects. Experiments were performed with several insecticides, and the conclusion arrived at that kerosene alone or in combination with carbon bisulphid is entirely inefficient, but that spraying with Paris green in the proportion of $\frac{3}{4}$ or 1 lb. to 20 buckets of water gives very satisfactory results. This remedy, it is explained, is also effective in destroying beet fleas.

Other insects noted as injurious to beets in this Government are the larvæ of *Plusia gamma* and of *Votys sticticalis.*—P. FIREMAN.

The pistol case bearer, V. H. LOWE (*New York State Sta. Bul. 122, pp. 221–232, figs. 12*).—The history, name, and appearance, life history, distribution, and natural enemies of this insect (*Coleophora malivorella*), which is not to be confounded with the cigar case bearer (*C. fletcherella*), are popularly discussed and 3 experiments with remedies briefly described.

In the first experiment Paris green was used at the rate of 1 to 150; in the second kerosene emulsion in the proportion of 1 to 10; and in the third, trapping the moths with trap lanterns.

The conclusions drawn are that Paris green used in the strength indicated will answer for this insect; that kerosene emulsion has no effect either upon the pistol case bearer or the cigar case bearer, and that the trap lantern method is unsatisfactory. In appended notes the reader is warned to beware of adulterated Paris green, and told how to test its purity with ammonia, in which it should be entirely soluble. Finally, the customary warning not to spray while the trees are in bloom is given.

A practical method of fighting cutworms in onion fields, F. A. SIRRINE (*New York State Sta. Bul. 120, pp. 183–196, pls. 6*).—The author states that the principal cause of the loss of the onion crop during 1895–'96 was the presence of cutworms. In Orange County in 1896, it is estimated that 46 per cent of the crop was lost through this agency, and in the same section in 1886 the loss was 50 per cent. The bait method, using dry bran or middlings, or equal parts of both mixed with Paris green, is recommended as the best means of fighting the cutworm in onion fields. This bait should be sown on the grass and weeds along the ditches bordering the onion fields, and also in drills in the fields. In the case of other garden crops, such as tomatoes, eggplants, sweet potatoes, cabbages, etc., it is advised that a tablespoonful of the bait be thrown about the base of each plant after it is transplanted, and that where possible it be scattered over the field a few days before the plants are transplanted. The history, habits, and distribution, so far as known, of the insect treated (*Carneades messoria*) are discussed and experiments with insecticides described.

In these experiments there were tested (1) the method of spraying the onion with a poisoned resin-lime mixture made of pulverized resin 5 lbs., fish oil or any animal oil 1 pt., concentrated lye 1 lb., and 5 gal. water, and used in the proportion of 1 part of the mixture to 160 gal. water; (2) spraying at night with kerosene emulsion; and (3) poisoned baits. The kerosene emulsion and poisoned lime mixture were found unsatisfactory in several respects. Of the various poisoned baits tested the one made of bunches of freshly cut grass dipped into a 1 to 80 solution of Paris green and water, and also the one made of bran and Paris green at the rate of 1 lb. of the latter to 50 lbs. of the former which was moistened, proved of small value as compared with the dry bait composed of bran or middlings and Paris green. The advantages claimed for the last are (1) it can be applied in drills about the margins of the fields and thus serve as a barrier; (2) it can be easily and uniformly applied with the onion seed drill; (3) it can be applied in drills along the side of the rows of onions; and (4) the trouble of mixing with water and ladling out in piles in the moist bran method is avoided.

A study in insect parasitism, L. O. HOWARD (*U. S. Dept. Agr., Division of Entomology Bul. 5, tech. ser., pp. 57, figs. 24*).—In 1895 the author undertook the careful investigation of the life history of the white tussock moth (*Orgyia leucostigma*), continuing the work until the autumn of 1896. So far as possible an endeavor was made to study the exact details of the fluctuations in the numbers of the moth. In 1895 there was a rapid and enormous increase in their numbers, but by the time the third generation had been reached, in September, it was noticed that parasitic and predaceous insects were also present in enormous numbers. The cocoons of the second generation were found to be the rallying point of immense numbers of ichneumon and chalcis flies. At the beginning of these studies but 7 parasites of this moth were known, but at the close of them the author had found 15 hymenopterous primary parasites, viz., *Pimpla inquisitor*, *P. conquisitor*, *P. annulipes*, *Amorphota orgyiæ*, *Meteorus communis*, *M. hypantriæ*, *Limneria* sp., *L. valida*, *Theronia fulvescens*, *Apanteles hyphantriæ*, *A. delicatus*, *Chalcis ovata*, *Pteromalus cupriodeus*, *Cratotechus orgyiæ*, *Telenomus orgyiæ;* 6 dipterous primary parasites, viz., *Frontina aletiæ*, *F. frenchii*, *Tachina mella*, *Euphorocera claripennis*, *Exorista griseomicans*, *Winthemia 4-pustulata;* 14 hymenopterous hyperparasites, viz., *Hemiteles townsendi*, *Bathyrix meteori*, *B. pimplæ*, *Adistola americana*, *Otacustes periliti*, *Habrocytus thyridopterigis*, *Pezomachus insolitus*, *Spilochalcis debilis*, *Eupelmus limneriæ*, *Dibrachys boucheanus*, *Elachistus cacœociæ*, *Elasmus atratus*, *Syntomosphyrum esurus*, *Asecodes albitarsis;* 3 probable parasites, viz., *Ichneumon subcyaneus*, *I. cœruleus*, and *Allocota* (*Hemiteles*) *thyridopterigis;* and 11 scavengers, viz., *Helicobia helicis*, *Sarcophaga* spp. 2, *Phora nigriceps*, *P. incisuralis*, *P. fasciata*, *P. agaraci*, *Limosina* sp., *Homalomyia scalaris*, *Gaurax anchora*, *Neoglaphyroptera bivittata*, and *Diplosis* sp. A species of Chrysopa was reared from a cocoon mass and the larvæ of *Anthrenus varius* were found feeding upon dead pupæ and empty egg masses, as also was the mite of the genus Tyroglyphus. Other active agents noted were an undetermined plant disease and the Heteroptera, *Podisus spinosus*, *Euschistus servus*, and *Prionidus cristatus*.

In all there were raised in the course of the study 2,122 primary parasites, of which 185 were dipterous and 1,937 hymenopterous. The number of secondary parasites, it is estimated, was about 1,000. The new species discovered were, among the hymenopterous primary parasites, *Amorphota orgyiæ*, *Apanteles delicatus*, and *Pteromalus cuproideus*, and among the hymenopterous hyperparasites, *Bathythrix meteori*, *B. pimplæ*, *Adistola americana*, *Pezomachus insolitus* *Eupelmus limneriæ*, and *Elasmus atratus*.

After the introduction, of which the above is a summary, the author considers in detail the various species of parasites noted and gives, in his concluding remarks, the following table, which shows the host relations of the hymenopterous parasites, so far as they are known or surmised:

Host relations of the hymenopterous parasites of Orgyia leucostigma.

Primary parasite.	Secondary parasite.	Tertiary parasite.	Possible quaternary.
Pimpla inquisitor	Dibrachys boucheanus	Asecodes albitarsis	
	Allocota thyridopterigis	Habrocytus thyr.?	
	Bathythrix pimplæ	Dibrachys boucheanus.	
	Adiastola americana		
Pimpla annulipes			
Pimpla conquisitor	Allocota thyridopterigis	Habrocytus thyr.?	
Ichneumon cœruleus			
Ichneumon subcyaneus			
Amorphota orgyiæ	Spilochalcis debilis	Dibrachys boucheanus?	Asecodes albitarsis?
	Dibrachys boucheanus	Asecodes albitarsis	
Meteorus communis	Spilochalcis debilis		
	Otacustes periliti		
	Bathythrix meteori		
	Dibrachys boucheanus		
Meteorus hyphantriæ	Spilochalcis debilis	Eupelmus limneriæ	
	Otacustes periliti		
	Dibrachys boucheanus		
Limneria sp			
Limneria valida	Dibrachys boucheanus	Tetrastichus sp.?	
	Eupelmus limneriæ		
	Elasmus atratus		
Theronia fulvescens			
Apanteles hyphantriæ	Spilochalcis debilis	Dibrachys bouch.?	Asecodes albitarsis?
	Dibrachys boucheanus	Asecodes albitarsis?	
	Elasmus atratus		
Apanteles delicatus	Spilochalcis debilis		
	Dibrachys boucheanus		
	Elasmus atratus		
Chalcis ovata			
Pteromalus cuproideus			
Cratotechus orgyiæ	Elachistus cacœociæ		
	Tetrastichus sp.?		
Telenomus orgyiæ			

The dipterous parasites were not found to be hyperparasitized.

The economic importance of the parasites of the tussock moth, as shown by the numbers that issued from 624 cocoons, may be readily determined from the following, in which the figures denote the number of specimens of the species obtained: *Pimpla inquisitor* 729, *Chalcis ovata* 69, *Dibrachys boucheanus* 50, *Euphorocera claripennis* 15, *Frontina frenchii* 14, *Bathythrix pimplæ* 13, *Tachina mella* 12, *Frontina aletiæ* 7, *Exorista griseomicans* 4, *Limneria valida* 1, *Theronia fulvescens* 1, *Asecodes albitarsis* 1. Breeding cage experiments showed the actual percentage of parasitism to be above 98 per cent. Later on in the season of 1896 the presence of the hyperparasites became more manifest, and many hundreds of *Dibrachys boucheanus* were reared from the cocoons of the Pimpla. Tertiary parasitism was found to be comparatively rare.

A few facts about insects, R. W. DOANE (*Washington Sta. Bul. 27, pp. 52, figs. 69*).—This bulletin forms a popular treatise on the subject of insects, its purpose being to give the average farmer or orchardist, who has little or no time to devote to the study of insects, some idea as to how they grow and breed, what changes they undergo, how they are classified, the more common of the different orders of insects, mites, spiders, and ticks, the natural enemies of insects (which are treated under the head of beneficial insects), and of various remedies and preventive measures that the farmer may employ. Under the head of preventive measures, high cultivation, clean culture, crop rotation, protection of plants by screens, etc., and late plowing are mentioned. The active measures noted are hand picking, trapping, and the use of external irritants and insect poisons. Directions are given for using Paris green mixtures, kerosene emulsion, the sulphur, salt, and lime wash, resin wash, whale-oil soap, white hellebore, tobacco, carbon bisulphid, and pyrethrum.

The effect of the poison of centipedes, F. C. KENYON (*Amer. Nat., 31 (1897), No. 336, pp. 544, 545*).

Three new aphides of the grapevine, V. MAYET (*Prog. Agr. et Vit., 14 (1897), No. 24, pp. 721–723*).—*Aphis papaveris* and *A. nerii* at Tlemcen and at Malaga, and *Rhizoctonus ampelinus* at Simferopol.

A peculiar insect enemy of the apple, F. H. HALL (*New York State Sta. Bul. 122, popular ed., pp. 5, figs. 8*).—A popular summary of Bulletin 122 of the station (E. S. R., 9, p. 257).

Gelechia (Sitotroga) cerealella Oliv., C. G. BARRETT (*Ent. Monthly Mag., 2. ser., 33 (1897), No. 85, p. 879*).—Imported from the United States in grain.

The clover mite, C. L. MARLATT, *U. S. Dept. Agr., Division of Entomology Circ. 19, 2. ser., pp. 4, fig. 1*).—A popular brief account of *Bryobia pratensis*, embracing the usual subjects. The occurrence of the mite on the Pacific Coast from San Diego to East Sound, Washington, at Las Cruces, New Mexico, in the Sierra Nevada Mountains in California, and in the Rocky Mountains in Montana, and at an elevation of 7,000 to 8,000 ft., is noted. Kerosene emulsion diluted with 5 parts water in winter is recommended in addition to the measures previously noted.[1]

On Coccus agavium Douglas, R. NEWSTEAD (*Ent. Monthly Mag., 2. ser., 33 (1897), No. 85, pp. 12, 13, figs. 4*).

Notes on Coccidæ from the royal gardens, Kew, E. E. GREEN and R. NEWSTEAD (*Ent. Monthly Mag., 2. ser., 33 (1897), No. 87, pp. 68–72, figs. 2; No. 88, pp. 73–77, figs. 5*).

Cochineal insect (*Amer. Monthly Micros. Jour., 18 (1897), No. 2, pp. 62, 63*).

The Cochineal of the vine of Chile, V. MAYET (*Ann. Soc. Ent. France, 65 (1897), No. 3, pp. 419–436, figs. 2*).—A biological sketch of *Margarodes vitium*.

The columbine borer (Hydrœca purpurifascia, G. and R.), M. V. SLINGERLAND (*Canadian Ent., 29 (1897), No. 7, pp. 161, 162, pl. 1*).—A description of the moth and larva. Fowler's solution poured around affected plants is noted as a remedy.

The periodical cicada in 1897, E. A. SCHWARZ (*U. S. Dept. Agr., Division of Entomology Circ. 22, n. ser., pp. 4*).—It is pointed out that brood XV of the 17-year locust will appear this year in Ohio, Virginia, West Virginia, and Pennsylvania, from which States it has been recorded, the XIII-year brood, VI, in Mississippi and Louisiana. The time of appearance of broods VII, XIV, XVI, XX, XXII, is also noted.

Forest moths that have become orchard and garden pests, W. W. FROGGATT (*Agr. Gaz. N. S. Wales, 8 (1897), Nos. 1, pp. 44–46, figs. 2; 3, pp. 135–137, figs. 7; 4, pp. 253–255, figs. 5*).—The mottled cup moth (*Doratifera vulnerans*), silver spotted plusia (*Plusia verticillata*), light ermine moth (*Pilosoma obliqua*), white shouldered looper (*Lophodes sinistraria*), Australian silkworm moth (*Antheræa eucalypti*), and banded skipper (*Pamphila augiades*).

The Hessian fly (Cecidomyia destructor), S. ROSTRUP (*Ugesk. Landm., 41 (1896), pp. 487–489*).

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[1] U. S. Dept. Agr., Divison of Entomology Bul. 4 (E. S. R., 9, p. 62).

Onion cutworms, their ravages and treatment, F. H. HALL (*New York State Sta. Bul. 120, popular ed., pp. 5, pls. 2*).—A popular summary of Bulletin 120 of the station (E. S. R., 9, p. 257).

Phylloxera vastatrix in São Paulo, F. W. DAFERT (*Relat. Inst. Agron. São Paulo, Brazil, 7–8 (1896), pp. 329–335*).—This insect was discovered in Brazil in 1893 by H. Potel. The report for 1894 of the commission formed for the study of the insect is given. The conclusions drawn from the study are that the entire territory must be considered as infested so as to further the work of destroying the pest. Governmental action is not recommended.

The raspberry cane maggot, M. V. SLINGERLAND (*Canadian Ent., 29 (1897), No. 7, pp. 162, 163*).—A technical description of the fly by D. W. Coquillett, who gives it the name *Phorbia rubivora*.

The San José scale in Kentucky, H. GARLAND (*Kentucky Sta. Bul. 67, pp. 43–59, figs. 3*).—The author discusses popularly the name and origin of this insect, its history in the United States, its food plants, the nature of its injury, methods of detection, and gives a brief description of it and its life history. The hydrocyanic-gas method is described at length, and, briefly, the salt-lime-sulphur solution, kerosene emulsion, and soap solutions. Legislation against the scale is recommended.

The bill framed by the national convention of people interested in the matter at Washington, March 6–7, 1897, is indorsed.

The strawberry weevil, F. H. CHITTENDEN (*U. S. Dept. Agr., Division of Entomology Circ. 21, 2. ser., pp. 7, figs. 4*).—The general appearance of the insect (*Anthonomus signatus*), its natural history and habits, distribution and injuries, and natural enemies are discussed. The species of parasites thus far bred from it are said to be *Calyptus tibiator, Bracon anthonomi, Catolaccus anthonomi*, and *C. incertus*. The various remedies which may be employed against the insect are (1) covering the beds with fine muslin; (2) since the insect feeds upon pollen, cultivation of pistillate varieties of strawberries; (3) planting trap plants such as staminate varieties here and there in the beds, or the red bud or bergamot, both of which may be of considerable value as lures; (4) keeping the bed perfectly clean of wild or volunteer plants and the burning over of the bed in spring.

The remedies which have been tried and failed are noted, and as a repellant a spray of crude carbolic acid in 1 per cent solution is mentioned. Arsenical spraying is thought scarcely advisable or practicable, although directions are given for it.

The woolly aphis of the apple, C. L. MARLATT (*U. S. Dept. Agr., Division of Entomology Circ. 20, 2. ser., pp. 6, figs. 2*).—The general appearance of the insect is described, its origin and distribution, natural history, and habits discussed, as well as remedies and preventives recommended. Under the head of remedies and preventives, the experiments of J. M. Stedman demonstrating the value of finely ground tobacco dust as an insecticide are noted and the advice given not to inject carbon bisulphid closer than 1½ feet from the crown of the tree.

A few insect enemies of the orchard, C. P. GILLETTE (*Colorado Sta. Bul. 38, pp. 33–40, figs. 3*).—Here are considered in a popular manner the San José scale (*Aspidiotus perniciosus*), Putnam's scale (*Aspidiotus ancylus*), Howard's scale (*Aspidiotus howardi*), the peach scale (*Lecanium persicæ*), the brown or clover mite (*Bryobia pratensis*), and the codling moth (*Carpocapsa pomonella*). The usual remedies against them are recommended.

Referring to the Paris green solution, it is stated that it has been found safe to use the poison in the dry atmosphere of Colorado at the rate of 1 lb. to 160 gal. of water instead of 1 lb. to 200 gal., usually recommended in Eastern States. The weaker mixture, however, may be used for the second and third sprayings.

Report of the entomological section, C. P. GILLETTE (*Colorado Sta. Rpt. 1896, pp. 143–147*).—The author reports on the occurrence within the State of grasshoppers, leaf rollers, flat headed borers, cossid borers, San José scale, codling moth (*Carpocapsa pomonella*), brown or clover mites (*Bryobia pratensis*), apple maggots (*Rhagoletis pomonella*), striped cucumber beetle (*Diabrotica vittata*), red spiders

(*Tetranichus* sp.), pear leaf blister mites (*Phytoptus pyri*), coleothrips, cabbage worms (*Pieris rapæ*), cabbage lice (*Aphis brassicæ*), rose leaf hopper (*Typhlocyba rosæ*), buffalo tree hoppers (*Ceresa bubalus*), Howard's scale (*Aspidiotus howardi*), and several other insects not named scientifically. The apple maggot and the striped cucumber beetle were reported to the station for the first time during the summer of 1896.

Entomological notes, W. W. FROGGATT (*Agr. Gaz. N. S. Wales, 8 (1897), No. 2, pp. 99–104, figs. 6*).—On the currant clear wing moth (*Sesia tipuliformis*), vine moth bug (*Arma sibellanbergi*), grape destroying beetle (*Monolepta diversa*), cherry bug (*Peltophora picta*), and peach moth (*Conogethes punctiferalis*).

Injurious insects and fungi (*Jour. Bd. Agr.* [*London*], *4 (1897), I, pp. 46–57, fig. 1*).—A popular account of the injuries of the branded fir beetle (*Pissodes notatus*) and gypsy moth (*Porthetria dispar*) in Massachusetts, and the peach leaf disease known as curl, caused by *Exoacus deformans.* For the latter, spraying with a Bordeaux mixture made of 3 lbs. of copper sulphate and 3 lbs. of lime in 50 gal. of water is recommended.

Experiments with woolly aphis or American blight (*Agr. Gaz. N. S. Wales, 8 (1897), No. 2, pp. 120, 121*).—Successful results were obtained with kerosene applied at the base of the tree, and with a band of wool soaked in castor oil about the tree trunk to prevent insects from ascending.

New codling moth spray (*California Fruit Grower, 20 (1897), No. 18, p. 1*).—Recommends soda-arsenic-lime mixture proposed by R. C. Kedzie, which can be made at the small expense of 4 cts per barrel. Two pounds of arsenic boiled with 7 lbs. of sal soda for 15 minutes in 2 gal. of water and 2 lbs. of slacked lime added. This may be diluted to make 800 gal.

The Gonin injector, J. RITZEMA BOS (*Tijdschr. Plantenziekten, 2 (1896), pp. 28–43, figs. 6*).—Describes an apparatus for injecting benzin, carbon bisulphid, etc., into the soil to destroy insects.

A parasite of hemipterous eggs, T. D. A. COCKERELL (*Canadian Ent., 29 (1897), No. 2, pp. 25, 26*).—A description of *Hadronotus mesillæ* n. sp., bred at Las Cruces, New Mexico, from the eggs of a hemipteron.

On combating the phylloxera in Russia, B. VITMER (*Selsk. Khoz. Lyesov., 182 (1896), pp. 609–627*).

The struggle against the grapevine leaf beetle, P. GERVAIS (*Prog. Agr. et Vit., 14 (1897), No. 15, pp. 442–446*).—The adult and the larval state are considered. Against the insect in the former state a mixture of pyrethrum solution (1 to 1½ kg. of the powder to 500 liters of water) with a solution of copper acetate made in the same proportions is considered the best of 3 mixtures mentioned, the other 2 being a solution of pyrethrum and soap, and a solution of pyrethrum, soap, and copper acetate. Against the larva a mixture of pyrethrum and sulphur in the proportions of 1 of the former to 3 of the latter is not thought as good as a mixture of pyrethrum and sulphosteatite. The proportions employed in this mixture were 15 parts of pyrethrum to 85 parts of the sulphosteatite, and was applied at the maximum rate of 30 kg. per hectare.

Spray pumps and spraying, W. PADDOCK (*New York State Sta. Bul. 121, pp. 197–219, figs. 15*).—An attempt is made to fill the want of elementary instruction in this subject. The reader is told when to spray, when not to spray, how to select a pump, how to work intelligently, how to prepare Paris green, kerosene, and copper-sulphate solutions, the Bordeaux mixture, and in the case of the latter how to weigh the lime and apply the potassium ferro-cyanid test. The greater portion of the bulletin is devoted to brief descriptions of spraying apparatus, including the pumps known as the Eclipse, Pomona, Casewell, Advance, Empire Queen, Geiger, Defender, bucket pumps, knapsack sprayers, the Lightning Potato Bug Killer, steam sprayers, horse-power sprayers, and several home-made conveniences and nozzles.

Spraying mixtures and their application, F. H. HALL (*New York State Sta. Bul. 121, popular ed., pp. 6*).—A popular summary of Bulletin 121 of the station (E. S. R., 9, p. 262).

A pneumatic spraying apparatus (*Scient. Amer., 77 (1897), No. 3, pp. 36, fig. 1*).—A knapsack-like apparatus in which the air forced into the tank agitates and forces out the liquid through a hose and nozzle. The nozzle has a tube for the passage of air and another for the passage of the liquid.

Note on Stilbum buquetii developed on a Vespa germanica, JACOBS (*Ann. Soc. Ent. Belge, 41 (1897), No. 4, pp. 119, 120, fig. 1*).—In the figure numerous filaments of the parasite are shown emerging from between the abdominal segments.

Two new parasites from Eupœya slossoniæ, W. H. ASHMEAD (*Canadian Ent., 29 (1897), No. 5, pp. 113, 114*).

FOODS—ANIMAL PRODUCTION.

Investigations of the potato as food, H. COUDON and L. BUSSARD (*Ann. Sci. Agron., 1897, I, No. 2, pp. 250–291, figs. 11*).—The authors made a study of the botanical structure of a large number of varieties of potatoes, as well as determinations of the relative composition of large, medium, and small potatoes and of the different parts of the tubers. The taste and culinary properties of a number of standard varieties were also investigated. The potatoes were prepared in several ways, by boiling, etc.

Among the conclusions reached were the following: In judging the value of a variety of potatoes analyses should be made of a number of entire tubers. The culinary value of the potato is directly proportional to its nitrogen content and inversely proportional to its starch content.

The different varieties of potatoes were found to vary greatly in their resistance to boiling, some retaining their form completely while others were almost entirely disintegrated. In the authors' opinion the resistance to boiling did not depend upon the content of pectin or starch, but seemed to depend principally upon the relative proportion of albuminoids present. No definite relation was observed between chemical compostion and early maturity. Generally speaking, the early varieties contained more water and nitrogenous material and less starch than the late varieties. The number of exceptions was, however, large.

In studying the structure and distribution of the constituents of the tubers X-ray photographs were made of cross sections. The albuminoid material was found to be more resistant to the X-rays than the medullary portion.

A study of the digestibility of cocoanut butter and cream butter, BOUROT and F. JEAN (*Compt. Rend. Acad. Sci. Paris, 123 (1896), pp. 587–590*).—The authors made an experiment with man to compare the digestibility of cocoanut butter (made from the fruit of *Cocus nucifera*) and cream butter. In order that sufficient quantities of fat might be consumed each kind of butter was made into a cake with flour. The test was of 12 days' duration and was divided into 2 equal periods. During the first period cake made with cocoanut butter was consumed and during the second period cake made with cream butter. In each case the total food contained 80.233 gm. nitrogen, 475.482 gm. fat, and 1,534.293 gm. carbon. During the first period the urine contained 19.33 gm. urea. The feces were separated by means of charcoal and contained 10.270 gm. cholesterin, biliary matter, and extractives, and 12.395 gm. fat. During the second period the urine contained 24.78 gm. urea and the feces 29.509 gm. cholesterin, biliary matter, and extractives, and 19.736 gm. fat. The coëfficient of digestibility of cocoanut butter was 98 per cent and of the cream butter 95.8 per cent. The amount of neutral fat, free fatty acid, fatty acid yielding soap soluble in water and the amount yielding soap insoluble in water in the ether extract of the feces was also determined in each case.

Dietary studies in New Mexico in 1895, A. Goss (*U. S. Dept. Agr., Office of Experiment Stations Bul. 40, pp. 23*).—A considerable part of the population of New Mexico and the Southwest is made up of Mexicans. Many of the people are in moderate circumstances and many are very poor. Three dietary studies were made; one of a family in moderate circumstances living in town and two of poor people living on a ranch. Customary methods were followed.[1] A number of Mexican foods were analyzed in connection with the studies and the composition of the others was taken from standard tables. The food of the poorer classes is almost entirely of vegetable origin. Flour and corn are used, the relative amount depending upon the resources of the family, corn being less expensive than flour. The native bean or "frijole," with peas and lentils, supplies the greater part of the protein. Cakes called "tortillas," made of flour or ground corn, are largely eaten. The "frijoles" are almost invariably cooked with a liberal addition of chili, or red pepper, and considerable lard. Chili is cooked alone and also eaten with other articles of food. This and "frijoles" are the most characteristic articles of diet. Tables are given showing the amount of food purchased, wasted, and eaten; its cost, composition, and fuel value. The results of the studies are briefly summarized in the following table:

Results of dietary studies—cost and composition of food per man per day.

	Cost of food.	Cost of beverages, etc.	Protein.	Fat.	Carbohydrates.	Fuel value.	Nutritive ratio.
	Cents.	*Cents.*	*Grams.*	*Grams.*	*Grams.*	*Calories.*	
Dietary of family living in city	6	2	104	71	701	3,960	1:8.3
Dietary of first family living in country	9	2	98	65	561	3,305	1:7.3
Dietary of second family living in country	6	1	89	77	625	3,645	1:9.0
Average	7	2	97	71	629	3,635	1:8.2

These studies are compared with the results of similar investigations in other localities in the United States and with the generally accepted standards. The author points out that much less food was eaten by families in New Mexico than in other localities. On the other hand, the

[1] U. S. Dept. Agr., Office of Experiment Stations Bul. 21 (E. S. R., 7, p. 148).

amount of carbohydrates was greater than usual. Very little food was wasted, the maximum being only a little over 3 per cent.

"These people can and do continually live, where provisions as a rule are expensive, on less than 7 cts. per man per day for actual nutrients and on less than 10 cts. per day when coffee and other articles not absolutely necessary are included. If the families studied had used more corn and less flour, as is often the case in families of the poorer class, the cost would have been still less."

The food of Italian university students, A. SERAFINI (*Arch. Hyg., 29 (1897), No. 2, pp. 141–184, tables 5*).—The author discusses at length the dietary habits of Italian university students, particularly those of the University of Padua. In his opinion the students may be divided into 3 classes, (1) those having an income of $30 to $40 per month, (2) those having an income of $16 to $18 per month, and (3) those having an income of $8 to $10 per month. The second class is by far the largest. The students ordinarily spend a considerable part of their income for amusements, etc., so that the sum actually expended for food is comparatively small. In the author's opinion the students of the first class have no necessity for economy in the matter of food, those of the second class must exercise economy, while those of the third class must depend upon the people's kitchens and other cheap eating houses. The food of the first class consists of a mixed diet, including bread, meat of various sorts, vegetables, fruit, macaroni, cheese, etc. The students of the second class have a more limited diet, consisting largely of meat, cheese, black bread, vegetables, and macaroni. Those of the third class consume much the same foods though in less variety, and the amount of meat eaten is very small. All classes drink wine in moderation.

The author reports 5 experiments with a healthy student, covering the dietaries followed by the different classes of students. Each continued 5 days except the last which was of 4 days' duration. The food, urine, and feces were analyzed. The experiments are reported in great detail. The amounts of nutrients consumed daily in the different experiments are shown in the following table:

Nutrients consumed per day.

	Dry matter.	Protein.	Fat.	Carbohydrates.	Ash.	Fuel value.
	Grams.	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Calories.*
Class 1	612.5	151.4	89.4	348.4	23.3	2,888.8
Do	509.5	116.9	51.8	325.0	15.8	2,290.3
Class 2	461.6	104.1	50.4	290.5	16.6	2,082.7
Do	337.4	79.1	37.9	207.5	12.9	1,528.0
Class 3	478.7	118.1	36.5	302.5	21.5	2,066.4

In the author's opinion the students of moderate and small means are not properly nourished. That this is not followed by more serious consequences is due to the fact that vacations are long and during vacations their diet is much more abundant. The severe application preceding examinations has a marked influence on the dietary habits and physical condition of the students.

The following table shows the coëfficients of digestibility of the various nutrients and the balance of income and outgo of nitrogen in the 5 dietary studies:

Coëfficients of digestibility and balance of income and outgo of nitrogen.

	Coëfficients of digestibility.					Fuel value of feces.	Nitrogen.			
	Dry matter.	Protein.	Fat.	Carbohydrates.	Ash.		In food.	In urine.	In feces.	Gain.
	Per ct.	*Per ct.*	*Per ct.*	*Per cent.*	*Per ct.*	*Calories.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*
Class 1	94.5	91.5	97.2	96.5	82.4	138.1	24.3	15.7	2.1	+6.5
Do	95.0	90.3	94.6	97.2	83.5	110.9	18.7	13.6	1.8	+3.3
Class 2	93.1	87.8	91.2	96.2	74.9	137.6	17.5	13.7	2.1	+1.7
Do	94.8	89.8	93.4	97.4	80.2	73.0	12.7	11.1	1.3	+0.3
Class 3	90.6	87.2	85.2	94.3	72.6	192.9	18.9	15.0	2.4	+1.5

Analyses of feeding stuffs, M. WEIBULL (*Tidskr. Landtmän, 17 (1896), pp. 294–299*).—The report is published as the fifth number of Contributions from Alnarp Laboratory, and gives analyses and discussions of concentrated feeding stuffs examined by the author during 1895–'96. The following results show the range in the constituents of 24 samples of wheat bran analyzed during the year:

Analyses of wheat bran.

	Minimum.	Maximum.	Average for good wheat bran.
	Per cent.	*Per cent.*	*Per cent.*
Moisture	9.57	13.91	11.0
Crude fat	2.62	4.06	3.5
Crude protein	11.55	17.10	15.6
Carbohydrates	60.56	66.79	64.7
Ash	5.10	12.92	5.2
Sand in ash	.10	9.82	.1
Rancidity, degree	6.00	40.00	12.0

The samples examined were classified according to their quality, as follows: Good, 61 per cent; average, 17; poor, 17; very poor, 5 per cent. The faults of the latter 2 classes were: Goods old or improperly handled, as shown by musty odor, a high degree of rancidity, and the presence in abundance of insects, molds, or fungi; or, adulteration of bran of inferior quality, oat hulls, weed seeds, screenings, or sand. The maximum content of sand found was 9.82 per cent. This sample also contained a large number of fungi and whole weed seeds, calculated to be at least 1,500,000 per 100 kg. The author recommends the practice of giving a rebate in case of bran containing a high content of weed seeds, on a scale similar to that adopted in the Province of Rhine-Prussia and Saxony, viz:

In case of a content of 10,000 to 20,000 weed seeds per 100 kg., 1 per cent discount; in case of a content of 20,000 to 40,000 weed seeds per 100 kg., 2 per cent discount; in case of a content of 40,000 to 60,000 weed seeds per 100 kg., 3 per cent discount.

Analyses of samples of rape-seed cakes, beet molasses, molasses feed, "cattle bread," and blood molasses, are also given in the article, and the value of the different feeds discussed.—F. W. WOLL.

Analyses of spurry hay and seed, B. BOGGILD (*Ugeskr. Landm.*, *42 (1897), pp. 55–57*).—Spurry (*Spergula arvensis*) is used to some extent in western Denmark as a food for milch cows and pigs. The ground seed is also fed. According to reports, as much as 6.6 lbs. of seed per head daily is sometimes fed to milch cows without producing any bad effects on the dairy products. Spurry is best adapted to light soils and may be grown on poor sandy soil or marsh land. The amount of seed required per acre is from 15 to 18 lbs. The average yield is 1½ tons of hay per acre. Analyses of spurry hay and seed are given in the following table:

Composition of spurry hay and seed.

	Water.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.*a*
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Spurry hay	13.71	9.19	2.86	44.68	23.75	5.81
Spurry seed:						
Spergula arvensis	9.85	11.43	8.92	36.63	13.87	*b*19.30
Spergula arvensis maxima	12.15	13.06	9.56	53.60	8.63	3.00

a Including sand. *b* Calculated ash in water and sand free material.

—F. W. WOLL.

Molasses pulp, a new feeding stuff, L. F. NILSON (*K. landt. Akad. Handl. Tidskr.*, *35* (*1896*), *pp. 218–222*).—The dried beet pulp from beet-sugar factories has been used to some extent as a cattle food by Swedish farmers, and with very satisfactory results. It may be fed in the following quantities per head and per day: Milch cows 3 to 4½ kg., fattening steers 5 to 7½ kg., working steers 4 to 6 kg., fattening sheep 0.3 to 1 kg., young cattle 1 to 2 kg.

The expense of drying the pulp is given as 4 cts. (15 ore) per 100 kg., and the price paid at the factory for the feed, $1.07 per 100 kg. (220 lbs.). A sample analyzed at the Alnarp chemical laboratory had the following composition: Water 9.38 per cent, ash 4.18, crude protein 6.67, ether extract 0.3, crude fiber 24.58, and nitrogen-free extract 54.89 per cent.

In order to utilize the large quantities of molasses which accumulate every season at beet-sugar factories, the method of E. Wüstenhagen[1] was adopted at the Trelleborg sugar factory (Sweden), and a dry cattle food of good keeping quality was made by drying the pulp with molasses. The following analysis shows the chemical composition of this feed:

Composition of feeding stuff obtained by drying molasses with sugar-beet diffusion residue.

	As sampled.	In dry matter.
	Per cent.	*Per cent.*
Water	9.870	....
Ash	6.670	7.400
Crude protein	8.670	9.620
Ether extract	*a*.650	.720
Cellulose	13.210	14.660
Nitrogen-free extract	60.930	67.600
Amid nitrogen	.557	.640
Albuminoid nitrogen	.810	.899
Proportion of total nitrogen in amid form	....	41.600
Proportion of total nitrogen digestible (Stutzer's method)	....	86.700

a Sugar, 24.3 per cent.

[1] Centbl. agr. Chem., 24 (1895), p. 29.

Basing the calculations on the average composition of molasses and beet pulp, it is found that the molasses pulp is made by drying molasses with an equal quantity of dried pulp or about 9 times its quantity of wet pulp.—F. W. WOLL.

Hay of Norwegian fodder plants, F. H. WERENSKIOLD (*Tidskr. norske Landbr., 3 (1896), pp. 328–332*).—This includes analysis of the following Norwegian fodder plants: Timothy, *Bromus arvensis*, *B. inermis*, *Dactylis glomerata*, *Festuca elatior*, *Agrostis dispar*, *A. vulgaris*, *Alopecurus pratensis*, *Avena elatior*, *Trifolium pratense*, *T. hybridum*, *Anthyllis vulneraria*, and *Astragalus bromoides*. The sample of the last-mentioned plant, cut in full bloom, showed a remarkably high protein content, its composition in air-dry condition being as follows: Water 14.22 per cent, total protein 24.38 per cent (digestible albuminoids 10.04, amids 11.04, and indigestible albuminoids 3.30 per cent), fat 2.24 per cent, nitrogen-free extract 31.72 per cent, crude fiber 22.03 per cent, and ash 5.21 per cent. The coëfficient of digestibility of the crude protein compounds, as found by the Kühn-Kellner method of artificial digestion, was 86.5 per cent.—F. W. WOLL.

The ensilage of potatoes (*Jour. Bd. Agr. [London], 4, No. 1, pp. 37–39*).—A brief summary is given of experiments on the ensiling of potatoes published in a recent number of *Bulletin des Séances de la Société Nationale d'Agriculture de France.*

Girard, Vauchez, and Marchal made experiments to ascertain whether the heat due to fermentation of fodder plants in silos could be utilized for cooking and preserving potatoes. The potatoes were buried in a silo filled with crimson clover. They acquired the characteristic color of the plant and the odor developed in fermentation. The tubers were flattened by the heavy pressure to which they had been subjected. When removed from the silo they were comparatively soft. They were examined microscopically and chemically, and it was found that they had been cooked by the heat of fermentation, and that they were rendered more digestible by the process.

That a high temperature (about 160° F.) was necessary to cook the potatoes was shown in an experiment by Mir made to determine whether corn could be preserved in a silo without cutting it up. A silo was filled by surrounding about a ton of potatoes with corn (whole plant). Upon opening, the corn and potatoes were both found in good condition. The tubers were somewhat flattened, as in the previous experiment, but were more cohesive. The cooking was found to be less advanced. The reason assigned was that the large size of the stalks and cobs of the corn diminished the pressure and consequently the temperature. Chemical analysis showed that the potatoes ensiled with the crimson clover had lost less water than those ensiled with the corn. The most striking difference, however, was the high percentages of cooked starch and of matter rendered soluble by fermentation, or in other words, the increased assimilability of the potatoes ensiled with clover. Traces of dextrin and soluble starch were found in the potatoes ensiled with the corn, while the normal insoluble starch amounted to nearly one-third of the whole amount of constituents. Girard believes that under similar conditions of temperature, pressure, and moisture the same results would have been obtained by ensiling potatoes with clover and with corn.

The crushed potatoes when removed from the silo lost weight very rapidly on exposure to the air, and formed a hard mass containing only 15 to 20 per cent of water. In this condition they could be kept for a long time. When required for feeding purposes they were soaked in water, which they readily absorbed, and thus regained their softness and digestibility.

Courmouls-Houlès ensiled chopped raw potatoes with about 2 lbs. of salt per 1,000 lbs. of potatoes, under pressure of 2,500 lbs. per square yard. The total cost of washing, chopping, putting in the silo, and weighting 50 tons of potatoes was about $15. The potatoes were put in the silo in the latter part of November. When the silo was filled the material was 5½ ft. deep. Sixty-two days later the silo was opened and the mass had sunk to a little over 3 ft. The temperature of the silo when filled was 39° F. and when opened it was 50°. The ensiled potato pulp was white, but became blackened on exposure to the air. Cattle ate this pulp greedily alone or mixed with cotton-seed cake.

De Monicault ensiled beet roots and potatoes by surrounding them with corn fodder. On opening the silo it was found that the appearance of the beets and potatoes was unchanged. The potatoes were somewhat soft, as if they had been boiled in water. On analysis the beets were found to contain 4.5 per cent sugar. Distillation gave no alcohol. In the experimenter's opinion, about two-thirds of the sugar of the beets had been lost by the process of ensiling. Neither soluble starch, dextrin, glucose, nor alcohol were found in the potatoes. Ensiling appeared to have caused a loss of water without really cooking the potatoes.

Steer feeding, J. H. CONNELL and J. W. CARSON (*Texas Sta. Bul. 41, pp. 877–910, dgms. 4*).—These experiments were in continuation of work previously reported in Bulletin 27 of the station (E. S. R., 5, p. 602). The bulletin contains a summary of this work since 1888.

Two tests are reported which were made to learn in what proportions cotton-seed meal and hulls should be fed to steers to make the greatest and cheapest gains in weight for long and short periods, and to ascertain whether cotton-seed meal and hulls can be fed in such quantity as to cause blindness or "fat sickness" in cattle under healthy surroundings.

The first test began December 1, 1894, and covered 120 days. Eight selected steers were divided into 4 lots of 2 each. The steers were 3 or 4 years old and showed Shorthorn blood. They were dehorned at the beginning of the trial. All the steers were taken from the range several weeks before this time to accustom them to their surroundings. Lot 1 was fed a minimum amount of meal and a maximum amount of hulls for 50 days, and a maximum of meal and minimum of hulls for 70 days, the average amount fed during the whole period being 6.34 lbs. meal and 15.52 lbs. hulls per head daily. Lot 2 was fed a "normal ration" of meal and hulls *ad libitum*, consuming on an average 5.88 lbs. meal and 17.83 lbs. hulls. Lot 3 was fed a maximum of meal and minimum of hulls, the daily ration averaging 5.98 lbs. meal and 10.77 lbs. hulls. Lot 4 received a minimum amount of meal and a maximum of hulls, the daily ration averaging 4 lbs. meal and 19.02 lbs. hulls. Each steer was fed separately.

The financial statement is based on high, medium, and low prices, viz, $18, $15, and $12 per ton for meal and $4, $3.50, and $3 per ton for hulls. The steers were rated at 2 cts. per pound at the beginning of the test and 3 cts. at the close. The average results are shown in the following table:

Results of first steer feeding experiment.

	Ratio of cotton-seed meal to hulls.	Average weight per head at beginning.	Average gain per head.	Cost of food per pound of gain.	Profit per head.
		Pounds.	*Pounds.*	*Cents.*	
Lot 1	1:2.4	764.0	231.0	3.88	$5.60
Lot 2	1:2.9	754.0	213.5	4.23	4.90
Lot 3	1:1.7	762.5	117.5	6.51	3.51
Lot 4	1:4.8	756.0	214.0	3.54	6.39

For purposes of comparison the gains made by the steers in a short period were also calculated. The average gains made per steer by the different lots during 70 days of the above test were as follows: Lot 1, 146 lbs.; lot 2, 146 lbs.; lot 3, 92.5 lbs.; and lot 4, 159 lbs. The average cost per pound of gain for the respective lots was 3.24 cts., 3.68 cts., 4.95 cts., and 2.89 cts.

The second experiment, which began December 4, 1895, and covered 120 days, was practically a duplicate of the preceding. Six range steers were divided into 3 uniform lots. The average daily ration per head of lot 1 was 9.38 lbs. cotton-seed meal and 14 lbs. cotton-seed hulls; of lot 2, 3.8 lbs. meal and 24.65 lbs. hulls; of lot 3, 7.06 lbs. meal and 21.67 lbs. hulls. The results are briefly shown in the following table:

Results of second steer feeding experiment.

	Ratio of cotton-seed meal to hulls.	Average weight per head at beginning.	Average gain per head.	Cost of food per pound of gain.	Profit per head.
		Pounds.	*Pounds.*	*Cents.*	
Lot 1	1:1.5	992.0	175.3	6.49	$3.80
Lot 2	1:6.4	994.3	239.6	3.58	8.53
Lot 3	1:3.4	1,022.0	239.6	4.55	6.51

The results for 80 days of this experiment were also calculated. During this time the steers in the different lots made the following average gains in weight: Lot 1, 152 lbs.; lot 2, 175.6 lbs.; and lot 3, 194.6 lbs. The average cost per pound of gain for the 3 lots was 5.62 cts., 3.27 cts., and 3.78 cts., respectively.

From these experiments the authors draw the following conclusions:

"For long and short fattening periods it seems clear that at current or probable prices of meal and hulls it pays best to feed some 5 or 6 lbs. of hulls to every pound of meal eaten.

"The largest daily gain in live weight can be secured by feeding meal and hulls in a very common proportion of 3 lbs. of hulls to 1 lb. of meal. The quicker gain, secured by increasing the amount of meal fed daily from some 4 lbs. to 6 lbs., increases the cost of feeding each steer $1.25 or $1.50 for every 100 days.

"Changing the amount of cotton-seed meal from a light feed of meal for first 50 days to heavy meal feed for last 70 days gave results of no marked value, although the change of ration clearly added to the cost of maintenance.

"We were totally unable to cause 'fat sickness' in steers fed on sound, dry cotton-seed meal and hulls when combined in various proportions and fed for 150 days, continuing into hot weather.

"When less than 2½ lbs. of hulls is fed to 1 lb. of cotton-seed meal the appetite is disturbed and indigestion is produced, resulting in light feeding and slow gains.

"From the trials here reported, we may safely conclude that when the price of a ton of cotton-seed meal as compared with a ton of hulls is as 5 to 1, then a pound of meal fed should be accompanied by at least 5 lbs. of hulls. When the difference in price widens, then the hulls should be correspondingly increased. Thus, if meal be worth $15 per ton and hulls $3, at least 5 lbs. of hulls should be fed to each pound of meal; if meal be worth $15 and hulls $2 per ton, 7½ lbs. of hulls should be fed to every pound of meal—provided the steers eat freely of the foods mixed in this proportion."

Feeding sheep in South Dakota, E. C. CHILCOTT and E. A. BURNETT (*South Dakota Sta. Bul. 55, pp. 20*).—A test was made with 45 lambs to compare the relative value of several common feeding stuffs. When purchased the sheep weighed about 54 lbs. per head. On September 30 they were turned on to a field of rape, where they remained until the middle of November. During the last 3 weeks of this time they had access to a grass pasture also. In addition they were fed some oats or oats and barley.

On November 16 the lambs were divided into 5 uniform lots and after a preliminary period on the rations they were to consume during the experiment, the test proper began November 28 and continued 17 weeks. During this time the lambs were fed 1.4 lbs. per head daily of the following grain mixtures: Lot 1 equal parts of corn, oats, shorts, and linseed meal; lot 2 corn and oats, 1:1; lot 3 oats and wheat, 1:1; lot 4 oats and barley, 1:1; and lot 5 wheat and barley, 1:1. In addition all the lots were fed 0.9 lb. of hay per head per day. The sheep were kept in pens and fed twice daily, and were supplied with salt.

At the close of the experiment the sheep were slaughtered and sold for 4 cts. per pound. The financial statement is based on hay at $3, shorts at $6, and linseed meal at $18.60 per ton, and oats and barley at

12 cts., corn at 20 cts., and wheat at 54 cts. per bushel. The results for each lot are shown in the following table:

Summary of sheep feeding experiment.

	Weight at beginning.	Gain in weight.	Dry matter eaten per pound of gain.	Cost per pound of gain.	Profit per lamb.
	Pounds.	*Pounds.*	*Pounds.*	*Cents.*	*Cents.*
Lot 1 (corn, oats, shorts, and linseed meal)	587	231	9.00	3.60	0.74
Lot 2 (corn and oats)	602	225	9.14	2.45	.94
Lot 3 (oats and wheat)	600	195	10.60	5.35	.37
Lot 4 (oats and barley)	570	206	10.00	2.80	.91
Lot 5 (wheat and barley)	582	217	9.67	4.42	.54

During the test 1 lamb in lot 3 died. One lamb was therefore dropped from all the other lots in comparing the results, except in the figures for profit per lamb.

Among the conclusions reached were the following: The greatest gains were made on the well-balanced ration fed to lot 1. The cheapest gains were made by lot 2.

Examination of the carcasses revealed the presence of two internal parasites, *Moniezia expansa* and *Thysanosoma actinioides.* They did not produce any definite effect on the condition of the sheep.

Corn, cowpeas, and wheat bran for fattening pigs, J. F. Duggar (*Alabama College Sta. Bul. 82, pp. 359–379, pls. 2*).—An experiment was made with 12 Essex pigs from 2 litters to determine the relative value of corn, cowpeas, and wheat bran. The pigs were about 5 months old and weighed on an average 46.8 lbs. They were divided into 4 uniform lots. On August 26 they were taken from the pasture and for 21 days were fed 2 lbs. of shelled corn per head daily. During this period the amount of food required per pound of gain for the different lots was as follows: Lot 1, 3.57 lbs.; lot 2, 2.92 lbs.; lot 3, 3.32 lbs., and lot 4, 3.14 lbs.

After a preliminary period of one week to accustom the pigs to a change in rations, the second period began September 23 and continued 16 weeks. Lot 1 was fed shelled corn, lot 2 cowpeas, lot 3 corn and cowpeas 1: 1, and lot 4 corn and wheat bran 1: 1. At first the corn and cowpeas were fed whole, but later they were coarsely ground. The pigs received all they would eat twice a day, and during the greater part of the experiment they were given a mixture of sulphur, hardwood ashes, charcoal, and iron sulphate. The digestible material in the different rations fed was calculated.

The financial statement is based on corn at 40 cts. and cowpeas at 50 cts. per bushel, and wheat bran at $15 per ton. The results of the second period are briefly shown in the following table:

Summary for 16 weeks' feeding of pigs.

	Total food consumed.	Total gain.	Food consumed per pound of gain.	Cost of food per pound of gain.
	Pounds.	*Pounds.*	*Pounds.*	*Cents.*
Lot 1 (corn)	844.2	173.3	4.87	3.48
Lot 2 (cowpeas)	954.2	198.0	4.81	3.61
Lot 3 (corn and cowpeas)	908.7	209.5	4.33	3.35
Lot 4 (corn and wheat bran)	1,044.4	203.0	5.21	3.61

The pigs were slaughtered and sold for 3 cts. per pound. At this price the corn fed is valued at 62 cts., the cowpeas at 62 cts., the corn and cowpeas at 69 cts., and the corn and wheat bran at 58 cts. per bushel. The financial returns for the different rations fed are discussed at some length. In the author's opinion such returns would only be profitable in a year of low prices for feeding stuffs, unless certain indirect benefits from feeding cowpeas are taken into consideration (green manuring, etc.).

The proportion of fat to lean in the different carcasses is discussed. On an exclusive corn ration the proportion of fat was greatest, averaging 2.3 per cent of the live weight; and on the cowpea ration least, averaging 1.1 per cent.

The urine and feces from the different lots of pigs were collected for 2 days and samples analyzed. The fertilizing constituents excreted in 24 hours by the 4 lots are shown in the following table:

Amount of fertilizing constituents in solid and liquid excrement of 24 hours.

	Nitrogen.	Phosphoric acid.	Potash.
	Pound.	*Pound.*	*Pound.*
Lot 1 (corn)	0.051	0.036	0.025
Lot 2 (cowpeas)	.083	.050	.036
Lot 3 (corn and cowpeas)	.072	.045	.018
Lot 4 (corn and wheat bran)	.086	.102	.029

The smallest quantity of manure was produced by the pigs fed corn alone. In the author's opinion this was due to the fact that they consumed less water. "The total value of the manure produced is considerably greater when the ration consists of cowpeas or of part cowpeas or wheat bran than when corn only is fed."

Molasses feed for pigs, G. FAYE and E. FREDERIKSEN (*Ugeskr. Landman, 42 (1897), pp. 15–17*).—In continuation of previous work (E. S. R., 8, p. 519) the authors report experiments on the value of molasses feed for young pigs. Twenty pigs, weighing on an average 25.5 lbs., were divided into 4 lots. All the pigs were given a basal ration of buttermilk and whey (or skim milk). In addition lot 1 was fed corn and barley; lot 2 was fed two-thirds corn and barley and one-third molasses feed; lot 3 was fed one-half each of the grain mixture and molasses feed; and lot 4 was fed one-third grain mixture and two-thirds molasses feed. All the lots received at first 1.3 lbs. per head daily of the grain or grain and molasses feed, the amount being increased to 3.8 lbs. toward the close of the experiment. The average gains in weight, food consumed per pound of gain, and cost per pound of gain are recorded in tabular form.

The average daily gain in weight for lot 1 was 1.02 lbs.; lot 2, 1.01 lbs.; lot 3, 0.97 lb.; and lot 4, 0.92 lb. The cost per pound of gain for the different lots was as follows: Lot 1, 4.2 cts.; lot 2, 4.07 cts.; lot 3, 4.2 cts.; and lot 4, 4.3 cts. At the close of the experiment the animals were slaughtered and flesh judged by an expert. The quality of the meat of the lots fed molasses feed was excellent. As much as 2.8 lbs. of molasses feed, equivalent to 1.86 lbs. of beet molasses, was fed per head daily during the latter part of the experiment without unfavorable influence on the health of the animals. Less food was required per pound of gain, and the gains in weight were more economically made when the grain was fed without the molasses feed than when both fed.—F. W. WOLL.

The food supply of Manchester, W. E. BEAR (*Jour. Roy. Agr. Soc. England, 3. ser., 8 (1897), II, No. 30, pp. 205–228*).—This article contains information on the source of supply of fruits and vegetables, and on market gardening.

Bread and bread making, L. BOUTROUX (*Le pain et le panification. Paris: J. B. Balliere & Fils, 1897, pp. 358, figs. 57*).—This is a handbook containing chapters on flour, milling, bread making (French and foreign), fermentation, chemical composition of bread, adulteration, and nutritive value of bread.

On the preservation of eggs, STRAUCH (*Milch Ztg., 26 (1897), No. 22, p. 342*).—Various methods were tried. The best results were obtained by coating the eggs with vaselin and placing in lime water, or by preserving in water glass (soluble glass).

Malt coffee, J. A. VOELCKER (*Jour. Roy. Agr. Soc. England, 3. ser., 8 (1897), II, No. 30, pp. 337–339*).—The inferiority of malt coffee to ground coffee is pointed out on the basis of analyses.

Meat inspection, C. A. CARY (*Alabama College Sta. Bul. 81, pp. 289–355, figs. 25*).—This bulletin is divided into 2 parts. After explanatory introductory remarks, the author gives a popular description of the symptoms and *post-mortem* appearances in acute and chronic cases of hog cholera; swine plague; tuberculosis of cattle, pigs, and birds; actinomycosis; anthrax; Texas fever; and malignant catarrh of cattle; together with suggestions on staining tubercle bacilli and on the recognition of putrefying meats. The method of procedure in *post-mortem* examinations is given.

The following animal parasites of domestic animals are also discussed: Tapeworm cysts or measles of cattle (*Cœnurus cerebralis, Echinococcus veterinorum*), liver fluke (*Distoma hepaticum*), kidney worm (*Stephanurus dentatus*), parasitic worms (*Strongylus micrurus, S. filaria, S. rufescens, S. ovis-pulmonalis, S. paradoxus, S. commutatis*), *Œsophagostoma columbianum*, the spine-headed worm (*Echinorhynchus gigas*), and *Ascaris lumbricoides, Lingulata tœnoides* and *L. denticulatum*.

Explanation of the terms used in reporting the analysis of a feed stuff, A. A. PERSONS (*Florida Sta. Rpt. 1896, pp. 66–68*).

Analysis of the velvet bean (fruit), A. A. PERSONS (*Florida Sta. Rpt. 1896, p. 65*).—The author reports the analysis of the fruit of the velvet bean (*Dolichos multiflorus*) as follows: Water, 11.93 per cent; protein, 18.81 per cent; fat, 6.29 per cent; nitrogen-free extract, 53.50 per cent; fiber, 7.45 per cent; albuminoid nitrogen 2.87 per cent; and ash, 2.02 per cent.

Prickly pears as fodder, W. J. BOYCE (*Agr. Gaz. New South Wales, 8 (1897), No. 4, pp. 260, 261*).—The prickly pear (whole plant) when cooked by steaming in a large covered boiler containing a small amount of water was found to be a satisfactory food for cattle. It was also relished by pigs. The prickly pear has proved particularly useful as a food stuff in certain regions of Australia in time of drought.

The value of beet molasses and molasses peat as cattle foods, R. WAHLQUIST (*Rpt. Ultuna Agr. Inst. 1895, pp. 53–65*).—Feeding experiment with 12 cows are reported. As much as 4 kg. per head per day of molasses peat produced no ill effects on the cows.

Feeding experiments with molasses feed, F. FRIIS (*Landmansblade, 29 (1896), pp. 647, 648*).—This is a preliminary report of feeding experiments with cows and pigs conducted at the Danish State Experiment Station at Copenhagen. The feed ($\frac{1}{3}$ palm nut meal, $\frac{4}{9}$ wheat bran, $\frac{1}{3}$ beet molasses) proved, in general, equally valuable, pound for pound, as grain feeds. No deleterious results were noticed in case of milch cows, even when 4 to 5 lbs. of molasses feed was fed per day.

The influence of increased atmospheric pressure on the metabolism and assimilation of nitrogen, N. A. SCHMITZ (*O vliyanii szhatagho vozdukha na obmyen azota i usvoenie azotistnikh reshchestv pishchi. Inaug. Diss. St. Petersburg, 1895, pp. 40, dgm. 1*).—Observations were made with 4 subjects, a man and 3 boys.

On the influence of the oxygen content of the air on metabolism, P. VON TERRAY (*Arch. gesam. Physiol. [Pflüger], 65 (1897), No. 7–8, pp. 393–446, fig. 1*).—The author made a number of experiments with a rabbit and a dog on the effect of variations in oxygen content of the air on metabolism. A small respiration apparatus was used.

The influence of milk sugar on the metabolism of protein and on intestinal putrefaction in healthy persons, I. P. SOLUKHA (*K voprosu o vliyanii molochnago sakhara na obmyen byelkov i kishechnoe thienie u zdorovbikh lyudeĭ. Inaug. Diss. St. Petersburg, 1896, pp. 90*).—Ten experiments are described. The subjects were healthy young men. Each experiment was divided into 2 periods. The food was the same in both periods, except that during the second period 75 gm. of milk sugar was taken daily in addition The nitrogen of the food and excretory products was determined.

Metabolism of nitrogen in healthy subjects when consuming milk charged with carbon dioxid and when consuming normal milk, I. L. KABAKOV (*Ob azotistom obmyenye u zdorovnikh lyudei pri upotrebyenii gazirovannago moloka v aravneniis prostnim. Inaug. Diss. St. Petersburg, 1895, pp. 50*).—Six experiments were made with men 24 to 29 years of age.

The formation of fat in the animal body, S. SOSKIN (*Jour. Roy. Agr. Soc. England, 3. ser., 8 (1897), II, No. 30, pp. 355–367*).—Reprinted from E. S. R., 8, p. 179.

The excretion of phosphorus in metabolism experiments when casein was consumed, G. MARCUSE (*Arch. gesam. Physiol. [Pflüger], 67 (1897), No. 7–8, pp. 373–394*).—In connection with the experiments with a dog on the comparative digestibility of casein and meat previously reported (E. S. R., 8, p. 513), the author also studied the excretion of phosphorus. The phosphorus in food, urine, and feces was determined. The principal conclusions reached was that when casein was fed the phosphorus was apparently better assimilated than on a diet of meat. The experiments are to be continued.

On the diurnal variation of nitrogen excretion by man, R. ROSEMANN (*Arch. gesam. Physiol. [Pflüger], 65 (1897), No. 7–8, pp. 343–392, dgm. 1*).—The author made a number of experiments, of which he himself was the subject, to study the diurnal variation in the excretion of nitrogen in the urine. The urine was collected night and morning and at intervals of 2 hours during the day. The experiments covered a number of dietary conditions, including fasting. In some cases the balance of income and outgo of nitrogen was determined.

On the influence of rarefied air, G. LEWINSTEIN (*Arch. gesam. Physiol.* [*Pflüger*], *65* (*1897*), *No. 5-6, pp. 278-280*).—Experiments were made with rabbits to study the effect of rarefied air. Rabbits died in from 2 to 3 days when confined in an atmosphere with a pressure of 300 to 400 mm. This corresponds to the atmosphere of an altitude of from 5,000 to 7,500 meters. The animals were dissected and the changes observed in the organs and tissues are discussed.

The influence of rarefied air and the air of high altitudes on man, A. LOEWY, J. LOEWY, and L. ZUNTZ (*Arch. gesam. Physiol.* [*Pflüger*], *66* (*1897*), *No. 9-10, pp. 477-538*).—A number of experiments in which the respiratory quotient was determined were made under various conditions with 3 subjects on Monte Rosa in the Alps. The results were compared with similar experiments made in Berlin. In the author's opinion the experiments showed that the air of high regions had a different effect from rarefied air. The latter causes little if any change in the metabolism during rest or work. The air of high regions, however, increased the general metabolism. The experiments are discussed at length.

Horse breeding in ancient and modern times, I. K. MERDER and V. E. FIRSOV (*Russkaya Loshad v Drevnosti ī Teper. St. Petersburg, 1896. Reviewed in Trudi Imp. Voln. Econ. Obsh.* [*Arb. K. freien ökon. Ges.*], *1897, I, No. 2, pp. 310, 311*).—This is a detailed report of an investigation of Russian horse breeding from the earliest times to the present day. On the supposition that the original type of the ancient Slav horse was Mongolian the author describes the modifications which this type has undergone due to crossing, etc.—P. FIREMAN.

On the feeding of swine with reference to the feeding standards and the quality of meat, F. LEHMANN (*Landw. Wochenbl. Schleswig-Holstein, 47* (*1897*), *No. 28, pp. 412-415*).—An address delivered before the Society of German Swine Breeders.

The computation of rations for farm animals, H. P. ARMSBY (*Pennsylvania Sta. Bulletin of Information No. 1, pp. 39*).—This is a popular bulletin, explaining the general principles of feeding, feeding standards, computation of rations, and fertilizing value of feeding stuffs, and showing the composition of feeding stuffs with reference to food and fertilizing constituents.

The chapter on planning a season's feeding is out of the usual order and brings the matter home to the farmer in a very plain, practical manner.

The raising of coarse-wool sheep in the southern Russian governments, N. CHIRVINSKI (*Selsk. Khoz. i Lyesov., 182* (*1896*), *pp. 721-761*).—The various breeds of sheep raised in southern Russia are described and their qualities from an economical standpoint discussed. The author points out that sheep with coarse wool, in consequence of their small productiveness, do not fulfill the present economical requirements and must therefore be improved or replaced by other breeds.—P. FIREMAN.

DAIRY FARMING—DAIRYING.

The udder of the cow, C. S. PLUMB (*Indiana Sta. Bul. 62, pp. 73-96, figs. 11*).—This bulletin gives a description of the cow's udder, illustrated by several original drawings, and an account of studies made on the udders of different cows and on the yield of milk from different parts of the udder.

"A good type of an udder, in its side outline, will very nearly have the curve of a part of a circle. If it is a fine udder, it will be carried beyond the lines of the circle, by an extension along the belly and well up behind toward the vulva. Such an udder, with 4 teats about $3\frac{1}{2}$ in. long, well placed under each quarter and not crowded, makes the very best type obtainable, as viewed from one side. Examined from the rear or front there should be considerable thickness, while viewed from below, the furrow separating the 2 glands should not be too deep. With these qualities should be secured great elasticity of tissue when the glands are emptied. The so-called meaty udder always looks too plump after being emptied, while the elastic one, following this operation, shows a well-shrunken or shriveled condition.

"The most common fault of the cow's udder, as commonly seen, is its inferior development in front. Often the hind part is well rounded out and carried well up behind, while the fore quarters are small and poorly developed, and instead of being carried forward a distance along the line of a circle, the front line is carried up to the belly quite vertically, as it were. While quite generally the fore teats hang on a little higher line than those behind, when the fore quarters are inferior in character, sometimes these teats are so much higher than the hind ones that the udder seems to terminate with the front line of the teats."

A comparison was made of the yield of milk from the front half and hind half of the udders of 65 different cows, representing several types of udder. In these comparisons the fore part was milked first. The results are tabulated in full. In 15 cases the yield was greater from the fore part than from the hind part and in 8 other cases it was the same from both parts. In the remaining cases the yield was larger from the rear part and usually the difference was quite considerable. "These cows, in 113 milkings, produced 474 lbs. 10 oz. milk from the fore part and 553 lbs. from the hind part, a difference in favor of the latter of 78 lbs. 6 oz., a gain of 16½ per cent, a no inconsiderable amount."

A test was made with 9 cows in which the milking was reversed, the hind part being milked first. "According to these figures, the fore udder yielded about the same amount, whether milked first or last. The hind udder, however, shows an average of 0.6 lb. more when milked first than last."

The effect of inferior front conformation on the yield was studied on 13 cows whose udders were more or less inferior in the fore part. The results showed "a very striking increase in favor of the yield of the hind udder as compared with the fore, amounting to a difference of about 57 per cent; such a difference would not exist were the fore udders in better balance with the hind parts."

The fore and hind parts of well-balanced udders were compared in case of 9 different cows.

"Here the difference in yield of the 2 parts is comparatively small, averaging only 0.2 lb. per day. It is important to note here, however, that not infrequently where the udder is well developed in front, the hind is carried out and up so high that the front part produces a notably less amount than the other part. . . .

"The practical bearing of this matter lies here. The average cow has an inferior udder and notably in its fore part. If now a judicious selection is practiced in breeding, may not a material gain in milk flow be secured by developing the fore part of the udder? It will be safe to say that there will be. The greater the development of the fore udder, the more perfect will the entire organ be likely to be, and the larger the relative amount of milk it will yield.

"To secure such a development, more care will have to be exercised in the selection of our cows in relation to the mammary gland. While constitutional vigor and digestive capacity should always receive first consideration, the breeder of dairy cattle cannot afford to breed inferior udders any more than can a breeder of trotters afford to breed slow-gaited animals for a fast track."

The effect of heredity on the conformation of the udder is brought out, and illustrations are given of different types of udders. The yield and fat content of the right and left gland were observed on 5 cows for 3 days. These cows were all believed to have perfectly normal udders.

"According to [the tabulated results] the gland which is milked first, gives slightly more than the one milked last, with a slight increase in fat per cent in the evening, and a very considerable increase in the fat per cent in the morning. The total yields, however, of each set of milkings of each gland do not materially differ, that of the right gland being 109 lbs. 2 oz. and of the left 108 lbs. 7 oz., a very inconsiderable amount."

Tests were also made on the effect of milking one teat at a time, and milking each in different order. The test included 4 cows in 4 successive milkings. The yield and fat content of the milk of each milking are tabulated.

"The results secured are not in accord with those of Dr. Babcock.[1] The writer fails to note any special influence on either milk yield or butter fat production, as is shown in the dairy records of the several cows. If, however, the average results from each cow are considered, there will be seen to be a tendency to produce milk slightly poorer in butter fat, in descending degree, from the first to the fourth quarter milked, although the quantity of milk in the several quarters is not materially affected. If we take the mean of the averages of the 4 cows, then a definite decrease in percentage and amount of butter fat from the first to the fourth quarter milked is shown. This amount, of course, is small, and it would in fact be unsafe to conclude from these figures that there is any material difference in the quality of the milk in the several quarters of the udder, when milked in different order of sequence.

"In order to study the results of this experiment from another point of view, all of the first milkings, from each quarter of each cow, were grouped together and the average figures secured. This was also done with the second, third, and fourth milkings. The average results thus secured, show no special influence on quantity or quality of the milk. Taking the 4 cows into account, it is impossible to arrange the milkings in any special order, showing one quarter to be in sequence richer or poorer in butter fat than another. The average of all the milkings of A, shows 5.46 per cent butter fat; for B, 5.34; for C, 5.40, and for D, 5.64 per cent.

"In conclusion, as stated by Dr. Babcock, 'It is doubtful about there being any difference in the physiological functions of the different quarters of the udder.'"

An appendix contains a technical description of the process of milk secretion.

The dairy industry in Missouri and Kansas, L. CHUBBUCK (*U. S. Dept. Agr., Bureau of Animal Industry Bul. 18, pp. 23, pls. 2*).—This bulletin treats of the development and the present condition of the dairy industry in the States of Missouri and Kansas. A history of the industry in the 2 States is given and mention is made of the loss occasioned by creamery "promoters" some 10 years ago. The advantages of the 2 States for dairying, their topography, water supply, supply of food materials, etc., are discussed.

"Regarding the suitableness of this region for producing dairy goods of high grade, it is only necessary to state that Missouri butter shown at the Columbian Exposition of 1893 scored within 1 point of perfection, and that Kansas butter was

[1] Wisconsin Sta. Rpt. 1889, p. 44 (E. S. R., 2, p. 428).

one of the first prize winners. As to possibilities of production, if one-tenth of the total area of Missouri and Kansas should be devoted to dairying, with 4 acres to a cow, and the cows yield an average of 200 lbs. of butter a year, there would be produced annually over 500,000,000 lbs. of butter, which, at 10 cts. a pound, would make $50,000,000, to say nothing of the returns from the skimmed milk fed to calves, pigs, and poultry.

"This, too, would mean an enormous increase in the value of farm property, because of better improvements, more careful saving of manure, and better systems of farming, all of which almost invariably accompany the development of dairying. . . .

"If properly managed, the corn fodder, which heretofore in the corn-growing States of the West has been largely wasted, can be converted into cow food of almost incredible value. There are grown yearly in Missouri over 6,000,000 acres of corn. Of this less than half is cut up for fodder, so that at least 3,000,000 acres of corn fodder are practically allowed to go to waste. This is enough to winter, on a liberal allowance and with other feed in proper proportion, 1,000,000 cows, which, if fresh in the autumn, could be made to yield a profit of $10 a head from the winter's feeding, making a total return of $10,000,000. . . .

"Uncut corn fodder is troublesome to handle in the barn, and if fed loosely in the yard most of it is wasted. The writer has fed corn to cows during the past winter in a way that is quite satisfactory. Stalls were made, each for 2 cows, but with a simple, long manger so wide and deep that an armful of uncut corn could be laid in at full length. Ears were not removed from the stalks, thus feeding to the cows the entire corn plant (minus the root). . . .

"The amount of refuse is surprisingly small. Considerable unmasticated and undigested corn passes through the cows, but with pigs to clean up after them this need cause no waste. After having fed corn in the different ways recommended, this method generally suits so well that the fodder cutter often stands idle in the winter."

As to the productiveness of the cows kept in Missouri, it is stated that "a very few dairymen make their cows yield an average of 7,500 lbs. of milk a year, from which they make 300 lbs. of butter. Much the greater number of cows kept for dairy purposes in the State yield less than 4,000 lbs. of milk a year, and from this the butter produced is less than 150 lbs."

The location and management of creameries and cheese factories is illustrated by charts and discussed.

"The average quality of the cheese made in Missouri and Kansas is not as good, comparatively, as that of the butter from the creameries of those States. . . .

"An extensive business in making Swiss cheese is being developed at California, Missouri. There are 5 factories in the county, one of which has been in operation 20 years. The others have been lately established. The annual output is now 125,000 lbs. Milk is delivered twice a day, for which 70 cts. a hundred is paid, the whey being returned to the patrons. The cheese sells at 11 and 12 cts. per lb. for No. 1 and 9 and 10 cts. for No. 2. It is shipped principally to Southern markets. Imitations of foreign kinds of cheese are not made in Kansas except in a very limited way; but a small amount of Swiss cheese is made at Enterprise."

In conclusion the State dairy organizations are noted and an appendix contains a list of the creameries and cheese factories in the 2 States.

The dairy industry in Nebraska, South Dakota, and North Dakota, J. H. MONRAD (*U. S. Dept. Agr., Bureau of Animal Industry Bul. 16, pp. 21*).—This bulletin reviews the status of the dairy industry in these 3 States, the technical dairy instruction offered, the extent and management of creameries and cheese factories, and statistics.

"From all obtainable data, an estimate has been made of the principal items connected with the dairy industry in these States. The figures given in the following table can not be verified, but there are good reasons for considering them approximately correct:

Extent and value of dairy interests in Nebraska, South Dakota, and North Dakota.

State.	Milch cows owned.	Value of cows (estimated).	Milk produced—yearly quantity and value. Average yield per cow.	Total milk produced annually.	Value of milk per cwt.	Total value of milk produced annually.	Creameries.	Cheese factories.
	Number.	*Dollars.*	*Lbs.*	*Cwt.*	*Cents.*	*Dollars.*	*No.*	*No.*
Nebraska	563,313	13,000,000	2,430	13,688,500	53	7,254,905	119	2
South Dakota	278,928	6,400,000	2,500	6,973,000	61	4,253,530	89	2
North Dakota	146,328	3,250,000	2,300	3,365,000	55	1,850,750	27	6

"The most probable cause of error in this table is the low annual milk yield assigned to the cows in these States, but the rates given are sustained by reports of actual facts, which appear to be reliable. The figures exhibit the average milch cow of this region to be an animal of very doubtful profit, for in South Dakota, which makes the best showing, the gross income per cow, in milk, would be but $15 a year."

The chapter on ladled butter gives a description of much of the farm butter brought to country stores and the way in which it is handled and "renovated," the result being known as "ladles." It is estimated that fully 9,200,000 lbs. of ladled butter was produced in 1895 from the 3 States named. "The extension of the creamery system is probably the surest and the quickest way of correcting the evil. But much farm-to-farm teaching of the elementary principles of caring for milk and of making and marketing butter is needed."

Dairy feeding as practiced in Pennsylvania, E. H. HESS (*Pennsylvania Dept. Agr. Bul. 16, pp. 125*).—This bulletin contains a popular statement as to the average composition of feeding stuffs, the use of feeding standards, principles of feeding and computation of rations, and the details as to the rations fed by 105 dairymen in Pennsylvania. The data for the latter were secured from replies to a circular letter requesting the dairymen of the State to give the weights of the different foods they were feeding. From these replies, calculations were made of the digestible constituents of each of the rations.

"There is a very wide variation in the different rations, which indicates that the matter of feeding dairy cattle has not received the thought and study to which it is entitled. About 25 per cent of the rations are, however, compounded in a very practical and scientific manner.

Summary of rations fed by 105 dairymen in Pennsylvania.

	Dry matter.	Digestible. Protein.	Carbohydrates.	Fat.	Total.	Cost of food.	Nutritive ratio.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Cts.*	
Maximum	46.45	5.44	23.94	1.70	32.33	30.1	1:12.8
Minimum	12.02	.81	6.24	.25	8.14	7.1	1: 3.6
Average of the 105 rations	24.42	2.06	12.81	.73	16.51	17.0	1: 7.5

"It will be noted that the largest amount of food in the rations is about 4 times that of the smallest. We must admit that there is a large difference between the digestive powers of different cows, but we can not see how 2 cows, each weighing 1,000 lbs., would be so widely different in their powers to consume and assimilate food.

"As a rule, the rations as used do not contain enough of protein, and I think that the dairymen of the State would do well to use more of the nitrogenous by-products, such as linseed meal, cotton-seed meal, gluten meal, brewers' grains, malt sprouts, buckwheat middlings, etc., than they have heretofore."

On the basis of the returns made by the dairymen, changes were suggested in the rations, and a condensed statement is given showing the original and improved rations. It is stated that the "average cow of this State does not pay for the feed she eats," and dairymen are urged to weed out their poor cows by the aid of the scales and the Babcock test. In conclusion a glossary is given of the terms used in feeding.

Rations for dairy cows and other matters of interest to dairymen, G. E. DAY (*Ontario Agr. Col. and Exptl. Farm Bul. 104, pp. 32*).—At the instance of the Ontario Agricultural College and Experimental Union, statistics were collected from about 170 of the most successful dairymen in 36 different counties in regard to the feeding and management of their herds.

"A wide variation existed [as to the length of time cows remained dry], the shortest time reported being 10 days, while the average for all replies was 57 days. By far the largest number lay between 6 and 12 weeks, and 8 weeks occurred in the reports more than twice as often as any other one time.

"Sixty-eight out of the 170 dairymen report cows dehorned; and with very few exceptions, they express themselves satisfied with the result. . . .

"Out of 170 replies, 142 reported horn flies troublesome, 23 reported them not very troublesome, and 5 reported them not troublesome. . . .

"Only 1 reply stated that complete soiling was practiced, but 140 out of 170 stated that pasture was supplemented by some kind of green fodders, while 53 stated that meal was fed, either throughout or during some part of the summer. . . .

"Out of 140 who used green fodders only 11 did not use corn. The most common combination consisted of oats and peas, or oats and tares for summer feeding with corn for autumn. A large number used corn alone, and hence did not commence feeding until late in the season, while the early soiling crops, rye, alfalfa, and clover, were comparatively little used."

Two methods commonly used in dehorning cows are given and various remedies and repellants applied against the horn fly.

The rations fed by 75 dairymen are stated and commented upon and for 31 of the more definite ones the digestible nutrients are calculated. The digestible protein in 21 out of the 31 rations calculated is considerably below the German standard or Woll's American average. The principles of feeding and the compounding of rations are explained, and tables showing the composition of various feeding stuffs are given.

The value of molasses feed for milch cows, R. WAHLQUIST (*Nord. Mejerie Tidn., 11 (1896), pp. 317–319*).—According to Ekstrand,[1] this feed is a mixture of peat dust and beet molasses, in the proportion of 20 to 80. The mixture is dry and keeps well, is easily handled, and

[1] K. landt. Akad. Handl. Tidskr., 35 (1896), p. 239.

is not sticky. The feed used had the following composition: Water 33.20 per cent, crude protein 1.14, ether extract 0.37, ash 5.82, crude fiber 2.73, and nitrogen-free extract 56.74 per cent.

Twelve Ayrshire cows at the Ultuna Agricultural Institute were fed in 2 lots, one lot receiving the regular summer feed throughout the experiment, while the other received up to 4 kg. of molasses feed in addition. No deleterious influence of the feed on the health of the animals was noticeable. The cows receiving it kept up in milk yield and in live weight fully as well as those receiving the regular summer ration.—F. W. WOLL.

Feeding experiments with milch cows, T. GÜNTHER (*Milch Ztg.*, *26* (*1897*), *No. 22*, *p. 340*).—Six cows were fed in 3 periods, receiving a mixed ration with fodder beets in the first and last periods, and fodder beets alone in the second period. The yield of milk fell off in the second period (9 days), but there was no perceptible change in composition. In the third period the yield gradually increased, but the fat content appeared to diminish. "The experiment showed that the change from a ration of beets with grain to one of beets alone was not capable of materially affecting the quality of the milk in 9 days."

The yield of milk of two Cheshire herds, C. T. PARKER (*Jour. Roy. Agr. Soc. England*, *3. ser.*, *8* (*1897*), *I*, *pp. 136–141*).—This is a record of the yield from 1893–'96 of 2 herds of Shorthorn cows, one of 48 and the other of 52 cows, considered in connection with a record for 7 years previous.[1]

"In only 2 cases did the number of weeks in milk fall below 40. The maximum individual yield . . . reached 1,482 gal., so that this cow gave nearly 7 tons of milk in a period of 50 weeks. In [another] case, the yield of 1,462 gal. in a space of 48 weeks is an equally noteworthy performance. Most of the high-yielding cows are from 6 to 9 years of age. . . . As examples of remarkable milking capacity . . . No. 40 gave over 1,000 gal. per annum for 6 consecutive years, No. 37 for 5 years, No. 46 for 5 years. . . . Over a period of 11 years, the average annual yield per cow ranged from 662 to 758 gal. at Grange Farm, and from 535 to 636 gal. at Woodhouse Farm, the mean annual yield at the former working out at 631 gal., and at the latter at 587 gal. per cow. Summarizing the whole of the results at both farms, we learn that a continuous measurement extending over a period of 11 years of the yield of between 80 and 100 cross-bred Shorthorn cows has given an average result equivalent to about 630 gal. of milk per cow per annum."

The composition of sows' milk, especially the fat content, PETERSEN and F. OETKEN (*Milch Ztg.*, *25* (*1896*), *No. 42*, *pp. 665–667; 26* (*1897*), *No. 23*, *pp. 356*, *357*).—In the first paper the results are given of the examination of 17 samples of sows' milk, taken with great precaution. The sows were of different breeds and various ages. The fat ranged from 5.80 to 12.09 per cent and averaged 7.56 per cent. Only a few determinations of solids and other constituents are given. The total solids in the 2 samples examined were 18.09 and 18.74 per cent respectively. The possible effect of time from farrowing, age, etc., is discussed.

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[1] Jour. Roy. Agr. Soc. England, 3. ser., 4 (1893), p. 172.

A communication is cited from the Royal Experiment Station for Middle Franconia, stating that the milk of a sow one day after farrowing was found to contain 9.15 per cent of fat and 21.75 per cent of solids, and 5 days later 4.7 per cent of fat and 16.98 per cent of solids; another from a landholder in Bavaria, stating that the milk of 2 sows several weeks after farrowing contained 9.8 and 8.6 per cent of fat, respectively; and a third from Speyer giving the results of 9 determinations as 2.95, 5.06, 8.00, 6.71, 3.58, 2.37, 7.32, 3.74, and 5.55, respectively. Averaging these 30 fat determinations gives 6.87 per cent.

At the request of practical breeders the work was continued. The second paper gives the fat determinations in the milk of a sow from February 12 to March 30. It was originally intended to study the variations on different kinds of food, the milk from the first and last part of the milking, etc., but the plan was interfered with by the difficulty of satisfactorily milking the sow. In the 30 determinations made the fat varied from 5.5 to 8.7 per cent and averaged 6.6 per cent. This confirms the previous observations as to the richness of sows' milk in fat.

Investigations on sheep's milk with special reference to the East Friesian milk sheep, H. HUCHO (*Landw. Jahrb., 26 (1896), pp. 497–547*).—This is quite a comprehensive study on sheep's milk, including the milk of Merino, Hampshire, and a number of other non-milk sheep, as well as East Friesian milk sheep. The milk of 3 East Friesian sheep was studied throughout a period of lactation, data being secured as to the yield and composition of the milk at frequent intervals, the morning's and night's milk, the fat globules, and effect of turning to pasture, of shearing, of time and manner of milking; and the nature and composition of colostrum. The following are some of the author's deductions: Non-milk sheep may produce, under normal conditions, from 40 to 80 kg. of milk in a relatively short period of lactation. During the first 2 or 3 months they produce about 20 to 40 kg., with a fat content of 3 to 4.5 per cent. East Friesian milk sheep give much more, about 200 kg. being a fair average. The following summary shows the range and the average composition of the milk of the 3 sheep for 1 period of lactation:

Composition of milk of East Friesian milk sheep.

	Sheep 1.		Sheep 2.		Sheep 3.	
	Range.	Average.	Range.	Average.	Range.	Average.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Water	85.82–76.55	82.53	85.77–80.19	83.21	85.44–80.41	83.55
Total solids	14.18–23.45	17.47	14.23–19.81	16.79	14.56–19 59	16.45
Fat	4.32–10.80	6.90	4.35– 7.50	6.09	4.15– 7.38	5.70
Casein	3.90– 8.93	5.41	4.12– 6.92	5.44	4.13– 7.90	5.33
Milk sugar	3.12– 5.37	4.35	3.81– 5.42	4.47	3.50– 5.41	4.55
Ash	.71– .98	.81	.88– 1.12	.97	.78– .99	.87
Specific gravity	1.0319–1.0440	1.0357	1.0337–1.0428	1.0379	1.0333–1.043	1.0374

With the advance of lactation, the specific gravity, solids, fats, protein, and ash increase more or less regularly, while the milk sugar decreases. There is no regular variation between morning's and night's milk when the interval between milkings is the same. Stall feeding is not good for the sheep. The claims made for the East Friesian milk sheep should be regarded with caution when the sheep are to be taken to another locality. In the opinion of the author, the use of the milk sheep as "the poor man's cow" is not to be recommended in general over the goat.

Studies on the souring of milk, H. HÖFT (*Milch Ztg., 26* (*1897*), *No. 14, pp. 211, 212*).—The author made experiments on the restraining influence of acetic, citric, oxalic, and lactic acid. Acetic acid restrained fermentation noticeably, in proportion to the amount added to the milk. Citric and oxalic acids both had a slight effect when added in considerable quantity; and lactic acid also restrained the fermentation.

In souring milk in vessels of different shape it was found that the souring went on most rapidly in a tall, narrow vessel, presenting a small surface of milk.

When equal quantities of cream and skim milk from the same separator were taken, the cream almost invariably soured more rapidly than the skim milk.

Milk and cleanliness, F. H. WERENSKIOLD (*Norsk Landmansblad, 15* (*1896*), *pp. 501–504*).—The author examined for microscopic impurities 46 samples of new milk, 3 of cream, 3 of centrifugal skim milk, and 12 of gravity skim milk. The samples were taken at milk depots or from the cans of milkmen in Christiania, Norway, and were examined according to Renck's method, with the following results:

Impurities in milk.

	Impurities per liter.	
	Range.	Average.
	Mg.	*Mg.*
Cream	0.2– 2.0	1.5
New milk	.1–11.0	2.6
Gravity skim milk	1.0– 4.2	2.1
Centrifugal skim milk	.0– .9	.3

The 25 samples of milk or cream from milk depots contained from 0.0 to 4.2 mg. of impurities, an average of 1.9 mg.; while the 39 samples from milkmen contained from 0.1 to 11 mg. per liter, an average of 2.6 mg.

For comparison the amount of impurities in a few other common articles of food was determined, and it was found that 1 kg. of common sugar contained 65.8 mg. of impurities; another sample of white granulated sugar contained 242.5 mg. per kilogram, and 1 kg. of table salt contained 366.0 mg. of impurities.

In case of 59 of the samples of dairy products examined, the impurities were subjected to microscopic examination; the author distinguishes between the following groups of impurities found in the samples, as follows: (1) Litter: Sawdust, peat dust, straw, and chaff particles; (2) fodder particles; neither of these components bear any evidence of having passed through the alimentary canal; (3) dung particles: Spores of a *Pilobolus* sp., fodder particles filled with mycelium and filamentous bacteria, epithelium cells, cow hairs, etc.; (4) particles of straining cloth or towels; and (5) particles originating from man, dyed and undyed woolen hairs, dyed cotton fibers, etc.

All samples examined contained mainly the particles belonging to group 1, but groups 2 and 4 were always represented; group 3 was only conspicuous in a marked degree in 2 cases; and group 5 was present in 40 to 50 per cent of the samples.—F. W. WOLL.

A simple method for determining fat in separator cream, M. WEIBULL (*K. landt. Akad. Handl. Tidskr., 35 (1896), pp. 370–379*).—The author determines the solids in the cream by drying on powdered pumice stone (not to exceed 6 gr. per 20 cc. pumice stone) for $2\frac{1}{2}$ hours at 100° C., and calculates the fat content from the following formula:

$$f = 1.1\ t - 9.5$$

where f = fat content, and t = total solids of the cream. The formula is based on the fact that the solids-not-fat of cream is comparatively uniform, viz:

$$t = f + \frac{100 - f}{100} \times a.$$

The value of the constant a varies with the different breeds of cows, and is assumed to be 8.7 in the formula for f given above. A table is constructed on the basis of this formula showing the fat contents of cream corresponding to total solids ranging from 17.7 to 42.1 per cent. If the cream to be tested is from breeds having a higher percentage of solids-not-fat than 8.7, the author recommends subtracting a certain fraction from the values given in the table, *e. g.*, 0.8 per cent for cream from cows of the Ayrshire or Shorthorn breeds, whose milk contains 9.4 per cent solids-not-fat (König).

The author compared the results obtained by the use of the preceding formula with gravimetric analysis in case of 19 samples of separator cream, and 8 samples of hand-skimmed cream, and also gives 21 cream analyses made by others where both total solids and fat in the cream were determined. The maximum difference obtained by the author with separator cream was 0.6 per cent, and the average 0.32 per cent, while hand-skimmed cream gave an average difference of 0.6 per cent. Six of the latter samples were from sour cream. The average difference for separator cream (23 analyses) was 0.27 per cent. The results show that the calculated fat content may differ more than 2 per cent from the gravimetric analysis in case of hand-skimmed cream which has soured before being sampled, and the method is therefore not recommended for such cream.—F. W. WOLL.

Statistics from fifty-two Wisconsin separator creameries, E. H. FARRINGTON (*Wisconsin Sta. Bul. 56, pp. 38*).—This bulletin is based on the result of visits to 52 creameries in different parts of the State. Observations relative to the equipment and general management of the creamery, the relation of the creamery to its patrons, efficiency of separators and various operations in the process of butter making were made and samples of the skim milk, buttermilk, and butter were analyzed at the station. The results of these observations are given in the text and tables. The summary of the analyses of the samples of butter taken from 52 creameries is as follows:

Summary of analyses of 52 samples of creamery butter.

	Water.	Salt.	Curd.	Sum of the water, salt, and curd.	Butter fat.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Highest	17.03	4.73	2.45	22.95	87.50
Lowest	9.18	1.30	.36	12.50	77.07
Average	12.77	2.87	1.28	16.92	83.08

"A few of these samples contained an extremely high or low percentage of each of the constituents, as will be seen by an inspection of the summary of the preceding table.

"The following statement shows the number of samples coming within the range given in the percentages of the various components:

"80 per cent of the samples contained between 10 and 14 per cent water.

"75 per cent of the samples contained between 2 and 4 per cent salt.

"80 per cent of the samples contained between 1 and 2 per cent curd.

"69 per cent of the samples contained between 80 and 84 per cent fat.

"60 per cent of the samples contained between 26 and 18 per cent water, salt, and curd.

"The average of over 350 butter analyses made by the writer or under his immediate direction during the World's Fair Dairy Test in 1893 was: Water 11.57, butter fat 84.70, salt 2.78, curd 0.95, and sum of the water, salt, and curd 15.3 per cent.

"A butter maker who reports an 'over-run' of more than 16 per cent is either incorporating an excessive quantity of water in the butter or his weights or tests of the milk are inaccurate."

The ripening of cheese and the rôle of microörganisms in the process, I. SHIROKIH (*Selsk. Khoz. Lyesov., 98 (1896), pp. 263–288*).—This is quite an extensive résumé of the work done on this subject by Duclaux, Freudenreich, Adametz, Lloyd, and others, with an account of some additional investigations by the author.

Analyses given by Duclaux indicate that the most characteristic change which takes place in the chemical composition of cheese in ripening is the conversion of nearly one-half of the casein into nitrogenous substances soluble in water.

In old cheese a still larger portion of casein is converted into soluble nitrogenous substances, among which are found a considerable amount of ammonia and other products of an advanced stage of decomposition. In brief it may be said that the process of ripening cheese reduces itself to a decomposition of the casein.

Duclaux and his followers ascribe the chief importance in the process to the peptonizing bacteria in general and to the representatives of the genus *Tyrothrix* in particular; *i. e.*, to bacteria which liquefy gelatin.

Freudenreich has been led to conclude that the gelatin liquefying bacteria (Tyrothrices, etc.) occur in cheese and milk in but small numbers; if added to cheese in great quantities they rapidly disappear except when introduced as spores. In the latter case they live in the cheese considerably longer but do not multiply. Admitting that the Tyrothrices play an important part in the ripening of cheese, it will be necessary, Freudenreich contends, to assume that they exist in the curd soon after coagulation and secrete a diastase which induces the ripening of the cheese. But since the Tyrothrices occur in milk and cheese in but limited numbers, he believes it improbable that they could secrete the diastase in a quantity sufficient to transform the whole mass of the cheese. While the bacteria liquefying gelatin disappear from the cheese very rapidly, even when introduced artificially in very great numbers, the lactic acid bacteria multiply in the cheese in enormous quantities. In consideration of this, Freudenreich thinks it probable that the lactic acid bacteria play the chief, if not the exclusive, rôle in the ripening of at least Emmenthaler cheese; in soft cheeses, *Oïdium lactis* and some other fungi coöperate with the lactic bacteria.

Adametz claims to have discovered a bacillus in Emmenthaler cheese possessing at first the properties of peptonizing bacteria and later those of a lactic ferment.

The author took up the study of the problem in question by preparing in milk pure cultures of some peptonizing bacteria as well as of lactic bacteria and then investigating by means of chemical analysis the changes which took place in the milk in the course of the development of the microörganisms in it. The change in the composition of the milk was studied as to (1) the quantity of the casein of the milk converted into a soluble form; (2) the amount of ammonia formed in the cultures, and (3) the amount and kind of fatty acids produced by the microörganisms.

With reference to the first point, it was found that while the peptonizing bacteria converted during the first 15 days of their culture almost all of the casein of the milk into proteids soluble in water and the remainder into products of decomposition, the lactic bacteria did not alter in the slightest the amount of nitrogen in the soluble protein matter after 30 days of culture. In other words, while the bacteria of the former group acted very energetically on the casein, those of the latter group did not affect it at all. The fungus *Oïdium lactis* was also found very active in changing the casein, although in a lesser degree than the peptonizing bacteria.

Further, the author found in the cultures of *Oïdium lactis* less ammonia than in those of the peptonizing bacteria, and none whatever in the cultures of the lactic bacillus.

Finally, on comparing the nature of the fatty acids formed in cheese (the author experimented with the hard Gruyère and the soft Brie cheese) and those produced by the bacteria in pure cultures, he found that the mixture of the volatile acids caused by the bacilli not liquefying gelatin did not correspond to those which are formed either in the hard or in the soft cheese. On the contrary, the volatile acids produced by the peptonizing bacilli were found to be very similar to the mixture of these acids produced in the ripening of the Gruyère cheese. And, lastly, great similarity was observed between the volatile acids of the soft Brie cheese and those produced by the fungus *Oïdium lactis*.

Thus all three lines of investigation pursued by the author lead to the conclusion that the bacteria of lactic fermentation, though present in the milk and cheese in very great numbers, do not induce the changes in the casein in the process of ripening, and if they exert any influence at all it is only indirect, since these bacteria do not dissolve casein, do not give off ammonia, and do not form the volatile acids characteristic of ripened cheese. The peptonizing bacteria and the fungus *Oïdium lactis*, on the other hand, produce all the changes of casein which take place in the ripening of cheese; th y yield soluble proteids and decompose albuminous compounds with the formation of ammonia and volatile acids corresponding to those occurring in cheese.

It is pointed out that the peptonizing bacteria would appear from the foregoing to play an exclusive part in the ripening of cheese, but such a conclusion would overlook the important fact established by the analyses of Bodzinsky, namely, that there is in cheese only a small quantity of peptone which is not precipitated by ammonium sulphate. In opposition to this fact the author found while investigating the nature of the soluble albuminous bodies in pure cultures of peptonizing bacteria that, under the influence of these microörganisms, the casein is converted almost entirely into peptone. In view of these opposing facts the author concludes that the joint action of the peptonizing bacteria and the lactic acid bacteria must be considered as essential to the ripening of cheese, and that this should serve as the starting point for future investigations of the process. The lactic acid bacteria are not capable of inducing this process, while the peptonizing bacteria, when they multiply without any check, carry on the decomposition too energetically and to an undesirable extent; but in the presence of lactic bacteria, which in a measure restrict and regulate the development and the activity of the peptonizing bacteria, the joint efforts of all these microörganisms give the desired result.

From this point of view the chief care in the production of cheese should be that both the peptonizing and the lactic bacteria are in the curd, and that the proper conditions for their life activity are provided. But the peptonizing bacteria, especially *Bacillus subtilis*, are very widely distributed and multiply with extreme ease; therefore from a practical standpoint no provision need be made for their presence and attention should be confined to the lactic bacteria.

Having defined the part which the peptonizing bacteria play in the ripening of cheese, the question still remains unsettled whether these bacteria which are, according to Freudenreich, present in hard cheese in small numbers, act as such in the process of ripening or by means of a diastase secreted by them at the beginning of the process. The author states that experiments made by him have shown that the diastase in question, named by Duclaux casease, acts just as energetically in the absence of the bacteria by which it is secreted as in their presence. From this it would follow that if casease is a factor in the ripening of cheese it would have to be present only in a small quantity.—P. FIREMAN.

On the ripening of cheese, O. JENSEN (*Tidsskr. for Fysik og Kemi, 2 (1897), pp. 92–114; abs. in Centbl. agr. Chem., 26, No. 10, p. 707*).—The author claims that in the ripening of cheese the caseinous matter is partially peptonized and rendered soluble by means of an enzym, casease, very similar to trypsin; that the microörganisms typical of cheese "fermentation" are more indirect than direct in their action; and that the cheese "fermentation" is probably not to be regarded as a true fermentation. He reports some experiments in ripening cheese with the aid of trypsin, as casease can not easily be obtained in large quantities. Experimental cheeses were made with skim milk pasteurized and unpasteurized. Into half the curd 20 cc. of pancreas was kneaded before putting to press. Ether was added to prevent the action of bacteria. It was found by analysis that the cheese made with pancreas contained nearly 50 per cent more soluble nitrogen than cheese made without the addition of pancreas.

Other experiments were made on a large scale at an estate. For several successive days 2 cheeses were made with the addition of pancreas ($\frac{1}{4}$ liter and $\frac{1}{2}$ liter per cheese) and 2 without. The cheese made with pancreas had the appearance of being much fatter than the control cheese. Analysis showed the following with reference to the nitrogen:

Soluble nitrogen in cured cheese.

	Cheese made without pancreas.		Cheese made with pancreas.	
	No. 1.	No. 2.	With $\frac{1}{4}$ liter of pancreas.	With $\frac{1}{2}$ liter of pancreas.
Soluble nitrogen:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Total	32.27	34.05	40.42	47.65
As proteids	12.69	14.62	20.63	25.13
As ammonia-free decomposition products	16.19	15.75	16.66	19.19
As ammonia	3.39	3.68	3.13	3.33

It is evident that the addition of pancreas increased the peptonizing in proportion to the amount of pancreas added. The total amount of soluble nitrogen was also increased, while the ammonia was slightly decreased. It was demonstrated that the soluble protein consisted, in part at least, of peptone. The ammonia-free decomposition products contained only a small proportion of amido acids.

The Köttstorffer saponification equivalent of the fat was 207.5 for cheese No. 1 and 204.9 for No. 4 (made with $\frac{1}{2}$ liter of pancreas), while for butter fat it averaged 227. The conclusion is that the cheese fat contains other substances besides butter fat, namely cholesterin, etc. There was nothing shown by the fat to indicate that the pancreas had had an especially unfavorable action upon the fat of the cheese.

The fungus flora of milk and its relation to the ripening of cheese, E. BAIER (*Milch Ztg., 26 (1897), Nos. 12, pp. 177–179; 13, pp. 193, 194*).—A number of studies were made of milk with the aid of "mixed sterilization"—antiseptics and heat. The most striking result was that the separate samples in the 3 experiments contained the same kinds of bacteria. Experiments with 15 mixtures of these bacteria in sterilized milk showed that only a few kinds could produce a strong varying aroma under these conditions of artificial symbiosis. The author believes certain relative proportions of the different kinds of bacteria are essential, and that the ripening process of a given kind of cheese is not due to a single kind of bacteria, or to an accidental condition of affairs. He predicts that the ripening process in general will come to be regarded as the product of the "dormant energy" of the milk (*i. e.* the microörganisms) and the energy (especially temperature) applied in the process of making.

New trials of the Thistle milking machine, WEITZEL-LANGEN (*Milch Ztg., 26 (1897), No. 22, pp. 338, 339*).—Reports very favorable results. The cows accustom themselves to the new method of milking quite readily and are milked dry. Thirty-five cows are milked in 40 minutes. The machine was found in every way satisfactory.

Examination of the fat content of the milk of Kildebrönd cows, L. HANSEN (*Ugeskr. Landm., 42 (1897), pp. 220–222*).

On the richness of milk in mineral and earthy phosphates, L. VAUDIN (*Ann. Inst. Pasteur, 11 (1897), No 6, pp 541–544*).

Preservation of milk by freezing, L. GRANDEAU (*Jour. Agr. Prat., 61 (1897), II, No. 27, pp. 44–46*).

The pasteurization of skim milk as a protection against the spread of tuberculosis (*Milch Ztg., 26 (1897), No. 21, pp. 326–328*).

Bacteriological investigations on kephir, E. VON FREUDENREICH (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 2; abs. in Milch Ztg., 26 (1897), No. 22, pp. 340, 341*).

Experiments on the effect of the food on the quality of butter, P. V. F. PETERSEN (*Mälkeritid., 1897, No. 12–14; abs. in Milch Ztg., 26 (1897), Nos. 19, pp. 291–293; 20, pp. 308–310*).

Failure of butter to "come" (*Abs. in Milch Ztg., 26 (1897), No. 22, p. 343*).—After feeding moldy clover hay the cream foamed in the churn and no butter could be obtained.

Cheese making in American factories (*Jour. Bd. Agr. [London], 4 (1897), I, pp. 33–36*).

Cattle raising and dairying, V. P. ZAVARÏN (*Lektzii po molochivnoui Khozyasstvou skotovodstvou, 1896. Reviewed in Trudi Imp. Voln. Econ. Obsh. [Arb. K. freien ökon. Ges.], 1897, I, No. 2, p. 316*).—An address delivered at the dairy school in Endomonovo.

Dairy farming, H. J. PATTERSON (*Maryland Sta. Bul. 47, pp. 74–85*).—This is a popular bulletin on the subject, the matter being originally read at a Maryland farmer's convention in 1896. It treats of the advantages of keeping good cows over ordinary stock; the profits from dairying, illustrating this by the record of a herd of 11 cows on a farm near the station; the care and feeding of cows with suggested rations; the advantages and obstacles confronting the farmers of central Maryland embarking in the creamery business; establishing coöperative creameries; prices paid for milk, and dairy literature.

"The principal disadvantages which we encounter are in the quality of animals at our disposal and the limited supply of good and cheap food on most farms. The pastures of the farms are too full of weeds and garlic, which are detrimental to a good quality of milk and butter. These are disadvantages, of course, which time and care can overcome, but they exist with us and would have to be encountered at the start.

"In the dairy business, as with all industries, there is always room for first-class products, and whenever and wherever they are produced they will be sought after and bring success to the community that produces them. . . .

"Though it may not seem expedient to establish a creamery for the production of butter, would it not be well for a community like this to start a milk and cream business, modeled after the best points in the plans of the Abbots of Philadelphia and the Copenhagen market of Denmark?"

Coöperative dairying in Ireland (*Jour. Roy. Agr. Soc. England, 3. ser., 8 (1897), II, pp. 340–344*).

Dairying in the Swiss lowlands, A. KRAEMER (*Die Landwirtschaft im schweizerischen Flachlande. Frauenfeld: J. Huber; abs. in Milch Ztg., 26 (1897), Nos. 22, pp. 337, 338; 23, pp. 353–356*).

Progress of dairying in Sweden (*Jour. Bd. Agr. [London], 4 (1897), I, pp. 62, 63*).

Extracts from the annual report for 1896 of the experiment station and school for dairying at Kleinhof-Tapiau (*Milch Ztg., 26 (1897), No. 21, pp. 328, 329*).

Our imports of dairy produce (*Jour. Bd. Agr. [London], 4 (1897), I, pp. 14–26*).

The milk trade of Berlin (*Milch Ztg., 26 (1897), No. 22, p. 342*).

Dairy schools, R. A. PEARSON (*U. S. Dept. Agr., Bureau of Animal Industry Bul. 17, pp. 38, figs. 2, pls. 4*).—This bulletin describes the development of dairy instructions, the purpose of dairy schools, their methods, equipment, and advantages; and an appendix shows the facilities for instruction in dairying now offered in the several States.

VETERINARY SCIENCE AND PRACTICE.

Sheep scab, C. P. GILLETTE (*Colorado Sta. Bul. 38, pp. 3–32, fig. 1*).—This paper, it is stated, is to be considered a report of progress rather than a report of work finished. The mite *Psoroptes communis*, the symptoms of the disease, its manner of spreading, and numerous experiments with some 25 dips are popularly described. Experiments were performed by dipping sheep and also with the mites themselves in the laboratory. What is known as the California dip, the potassium sulphid dip, the Cooper dip, the black leaf dip, the "Skabcura" dip, the "Zenoleum" dip, the "Chloro-naphtholeum" dip, and Quibell's liquid dip were tried both upon the sheep and in the laboratory. The Fort Collins lime-sulphur dip was tried upon the sheep only. The sulphonaphthol dip, the Quibell dry dip, the carbolic acid, the arsenite of soda dip, the Australian dip, the copperas dip, flour of sulphur (dry), flour of sulphur in water, the Curtis dip, milk of lime, tobacco decoction, carbolic acid and corrosive sublimate, kerosene emulsion, kerosene, alcohol, and whale-oil soap were employed in the laboratory only. Nearly all of the last, with the exception of sulpho-naphthol, gave but poor results in the strengths employed and in the time for which the mite was exposed. The Fort Collins lime and sulphur dip (lime 11 lbs., sulphur 33 lbs., water 100 gal.) seems to have given fair results. The California dip (sulphur 100 lbs., lime 25 lbs., water to make 100 gal.) proved equally good, as did also the potassium sulphid dip (sulphur 60 lbs., sal soda 9 lbs., boiled together and diluted to make 200 gal). Cooper's dip is less favorably reported. The black leaf dip, used in the strength of 1 to 600, is similarly reported, but used in strengths of 1 to 200 it seemed to give good results. Experiments were also made with the eggs and with the mites to determine the effect of exposure. As a result, it was found that both readily succumbed to low temperatures, from which it follows that infection can not be carried over winter by the mites or eggs in the ground or buildings and that it is improbable that either mites or eggs will live at any time of the year for more than a very few weeks unless upon some animal which may serve as food.

Experiments on the effect of dipping on the growth of the sheep showed that there was a loss of about three-fourths of a pound per sheep during the week following the dipping; but this loss will depend largely upon the degree of cold and the manner in which the sheep are subsequently handled. It must be taken into account in calculating the cost of dipping if made shortly before the animals are sold.

The author thinks the claims made that certain patent dips have some beneficial tonic effect are not to be trusted. Under the head of general directions for preventing and curing the scab, it is recommended that newly purchased lambs or sheep coming from a locality where the scab is known to be present ought to be dipped at least once, or better, twice. There is no certainty of killing all the insects with even the best dip after 2 dippings 14 days apart, especially if put back into the old yards. Further, those employing the lime and sulphur dips are warned not to use more than 1 lb. of lime to 4 lbs. of sulphur, as it is the excessive lime which injures the wool.

Abortion in domesticated animals, C. F. DAWSON (*Reprint from Jour. Comp. Med. 1897, Feb., Mar., and Apr., pp. 15*).—The author briefly passes somewhat critically over the literature on the subject of abortion, bringing out the fact that it teems with contradictory statements both from members of the veterinary profession and from laymen. No data proving that abortion occurs through sympathy is found, though it seems possible that the nervous system might receive such a shock as to produce it.

Abortion resulting from kicks, blows, disgusting sights, odors, etc., is classed as due to external causes, and it is stated that there may be sporadic abortion from internal or systematic causes. Thus a severe lung disease, limiting the respiratory area, causes an imperfect oxygenation of the blood. A badly ventilated stable, containing many animals, might, by reason of the accumulation of carbon dioxid and other poisonous exhalations, be the cause of abortion. Other causes are noted, and the theory is advanced that sporadic abortion may be due to a bacterial parasite. Experiments are cited showing that an injection of matter obtained from the genital passages of aborting animals or of cultures made from such matter will produce abortion. The bacillus isolated in cultures from vaginal secretions of aborting animals when injected into rabbits produces death, the disease simulating hog cholera, though in hogs it causes nothing more than a temporary anorexia. Dr. Theobald Smith, who made the cultures and the injections, believes that the organism is closely related to the bacillus of hog cholera.

The author's method of collecting the vaginal secretions for cultures is described, and the fact noted that the flora of the bovine vagina seems to be very extensive, but appears to be limited to some extent by the number of species swallowed by the animal with its food.

Bovine tuberculosis in Indiana, A. W. BITTING (*Indiana Sta. Bul. 63. pp. 99–116, pls. 2, dgm. 1*).—In this bulletin the author discusses in a popular way the prevalence of tuberculosis in man and animals, its contagiousness, the bacillus producing it, predisposing causes, the effect of the disease upon the body, the symptoms, and treatment by tuberculin. Under the last heading temperatures are given for 6 animals tested by the author, work by Law[1] with tuberculin upon healthy animals is referred to, and mention is made of the experiment of Bang[2] in changing a diseased herd into a healthy one without slaughtering all diseased animals. Precautionary measures against the disease are noted at length and the necessity for thorough inspection is emphasized.

Splenetic or Texas cattle fever, E. P. NILES (*Virginia Sta. Bul. 61, pp. 19–26*).—This bulletin briefly describes the nature, method of infection, symptoms, pathology, and treatment of Texas fever, with a list of the counties in Virginia quarantined against it. Treatment with quinin and purgatives is advised and strenuous efforts to avoid the presence of cattle infested with ticks are insisted upon. The Governor's proclamation in regard to quarantines in the State, the rules and regulations of the Board of Control, and the Virginia law in regard to quarantine are quoted.

Infectious abortion in cattle, B. BANG (*Ugeskr. Landm., 41 (1896), pp. 415–418*).

Tuberculosis and the tuberculin test, J. KING (*Jour. Roy. Agr. Soc. England, 3. ser., 8 (1897), II, pp. 319–324*).—A report on test experiments, etc. Among other things it is noted that in the city of Manchester in 1894 there were 72 carcasses condemned as unfit for food; in 1895 there were 98, and in 1896, 108. The figures show the prevalence of the disease. In most cases the carcasses were of animals slaughtered as apparently healthy, but later found to be generally affected. An examination of 398 head of cattle, embracing cows, heifers, bullocks, bulls, and calves, showed 27.63 per cent affected and 3.76 per cent unfit for food. The percentages of the different animals affected were cows 41, bulls 25, heifers 21.77, and bullocks 16. Of the animals found unfit for food 6.55 per cent were cows and 2.42 per cent heifers.

Bovine tuberculosis, J. STEWART (*Agr. Gaz. New South Wales, 8 (1897), No. 4, pp. 256–259*).—Treats of its introduction, progress, and dissemination in New South Wales, and advises quarantine measures.

Practical methods of demonstrating tubercle bacilli, W. N. SHERMAN (*Amer. Monthly Micros. Jour., n. ser., 18 (1897), No. 3, pp. 92–95*).

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[1] New York Cornell Sta. Bul. 82 (E. S. R., 6, p. 23).

[2] Massachusetts Hatch Sta. Bul. 41 (E. S. R., 8, p. 624).

Ætiology of dysentery, W. JANOWSKI (*Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No. 3, pp. 88–100, 151–158, 194–202, 234–255; abs. in Jour. Roy. Micros. Soc.* [*London*], *1897, No. 3, pp. 239, 240*).—As the result of a review of 84 works on the subject of dysentery, it is concluded that it is caused by a coöperation of several parasites. Two forms of the disease are distinguished, (1) the ordinary form due to associated bacteria; and (2) the tropical, which is probably caused by the coöperation of an Amœba and bacteria.

Parasitological notes, B. GALLI-VALERIO (*Moderno zooiataro, 1897; abs. in Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No. 17–18, pp. 679*).—The geographical distribution of some Italian species of parasites is discovered. The following are noted: *Actiomyces lacertæ* from the liver of *Lacerta agilis*, *Cysticercus fasciolaris* from the intestines of *Acciptiter nisus* or *Falco tinnuiculus*, *Bothriocephalus* n. sp. from the intestine of *Squalius cavedanus*, *Heteracis papillosa* from the intestines of *Phasianus versicolor* and *P. cholchicus*, *Trichocephalus nodosus* from the intestines of *Mus musculus*, *Trichosoma longicolle* in the serous membrane of the ingluvies of *Phasianus versicolor* and *P. cholchicus*, *Filaria lobiato papillosa* larvæ from the vessels of the tongue of an ox, and *Sarcoptes mutans* from *Phasianus versicolor*.

How the bacterial organisms are studied, J. E. LAMB (*Amer. Monthly Micros. Jour., n. ser., 18 (1897), No. 6, pp. 184–188*).—The technique of the subject.

Departmental committee on swine fever (*Jour. Roy. Agr. Soc. England, 3. ser., 8 (1897), II, pp. 367–371*).—From their investigations the committee has concluded that pneumonia of the pig is sporadic and not contagious or epizoötic; that swine erysipelas is not common in the acute or contagious form in England; and that there is no epizoötic disease of swine, except swine fever, in any part of the United Kingdom that requires to be dealt with under the act of Parliament for 1894 relating to diseases of animals.

Chicken cholera in Australia, C. J. POUND (*Report relating to the microbes of chicken cholera. Queensland, Australia, 1897, pp. 22, figs. 2; abs. in Jour. Roy. Micros. Soc.* [*London*], *1897, No. 3, p. 240*).—The discovery of the disease in Australia is reported.

Rational horse shoeing, K. I. KALNING (*Ouchenie o Ratzionalnoĭ korkye losh adeĭ. Kasan, 1896, figs. 121. Reviewed in Trudi Imp. Voln. Econ. Obsh.* [*Arb. K. freien ökon. Ges.*], *1897, I, No. 2, pp. 313, 314*).

AGRICULTURAL ENGINEERING.

Summary of mechanical tests on thirty-two species of American woods, B. E. FERNOW (*U. S. Dept. Agr., Division of Forestry Cir. 15, pp. 11, dgms. 2*).—A summary is given of the results of mechanical tests conducted under the supervision of J. B. Johnson on timber from 7 species of pine, 10 of oak, 7 of hickory, 2 of elm, 2 of ash, and 1 each of bald cypress, white cedar, Douglas spruce, and sweet gum.

In addition to the regular series of tests a number of special investigations were undertaken which are reported upon at more or less length. Many of the special tests were inconclusive and are to be reported upon in detail in a future publication. Among the experiments in which apparently definite results were obtained was the bleeding of long-leaf pine, which has already been reported.[1] The effect of moisture on wood after seasoning was investigated, and the results seemed to indicate that no material difference in strength exists, so that it would be immaterial whether a given moisture condition was acquired by drying or by reabsorption after having been fully sea-

[1] U. S. Dept. Agr., Division of Forestry Bul. 8 (E. S. R., 5, p. 96).

soned. The effect of hot-air treatment in dry kilns was studied, and contrary to common opinion the results show that it has no detrimental effect. Different processes which apply high temperature and pressure to increase durability and strength of wood were investigated, and it was found that the claims as to effective chemical changes were unfounded, and as to strength the effect was either negative or injurious. The effect of immersion of timber as influencing its strength beyond the simple moisture effect was tested, and so far as the results go it was proved that the material was practically unaffected by immersion for periods of as much as 6 months' duration.

Clearing land, F. A. HUNTLEY (*Washington Sta. Bul. 28, pp. 17, figs. 4*).—An account is given of the methods pursued and the results obtained in the clearing of a tract of land for experimental purposes at the Puyallup Substation.

"No standing timber excepting a limited amount of young or second growth occupied the ground when the clearing was begun. Logs were in great abundance, but were of little or no value by reason of knotty growths or partial decay. The original forest consisted very largely of fir on the dry clay soil and cedar in the moist locations. There were a limited number of stumps of ash, maple, and alder, but these being of the deciduous class were found advanced in decay, and were easily taken out. The scanty second growth of alder and shrubbery added nothing of importance to general expenses."

The most troublesome problem connected with this work was the removal of the stumps, and blasting was adopted as the most practical means of accomplishing this, giant powder and Judson powder being the explosives used. A detailed description is given of the tools employed and the methods used in laying the blasts. The average expense per stump was a little less than 77 cts. The average cost per acre of clearing was $101.71.

Irrigation in South Dakota; plat work with forage crops, etc., J. H. SHEPARD and E. C. CHILCOTT (*South Dakota Sta. Bul. 52, pp. 1–23, 31, 32, pls. 7*).—A discussion on irrigation in South Dakota and a report on experiments conducted to determine the effect of artesian well water upon vegetation. Forty plats of various forage crops were irrigated, and the results seemed to show that the water and its salts are beneficial. An analysis of the water is given.

The application of wind as motive power, P. LA COUR (*Ugeskr. Landm., 41 (1896), pp. 424–426*).

Trials of agricultural machinery conducted at the eighteenth general Swedish agricultural fair at Malmo, 1896, S. RHODIN (*Redogörelse för den särskilda redskapspröfningen till 18da Allmänna Svenska Landtbruksmötet i Malmö. Lund, 1896, pp. 207, figs. 83*).

Tests of American double and single plows, F. BOKELMANN (*Tidsskr. Landökon., 15 (1896), pp. 513–547*).

Cold storage for farm products, G. L. CLEMENCE (*Agr. Massachusetts, 1896, pp. 226–236*).—A popular article on cold storage on the farm and the construction and management of cold-storage houses for farmers' uses.

Silos and silage, E. C. CHILCOTT (*South Dakota Sta. Bul. 51, pp. 20–32, figs. 3*).—A popular article on the use of silos, the ways to build them, and their cost. The construction of the station silo is described in detail. Several figures are given to explain details of construction.

Report on road making, A. W. Campbell (*Rpt. Provincial Instructor in Road Making, Ontario, 1896, pp. 80, pls. 8, figs. 3*).—This report is divided into 3 parts, country roads, town streets, and an appendix including miscellaneous reports, road laws, etc. The topics treated under the head of country roads are statute and convict labor, existing roads, road metal, rolling country roads, drainage of macadam roads, dimensions of country roads, crowning the road, hills, embankments and cuttings, location of roads, repair and maintenance, road machinery, bridges and culverts, wagon tires, instruction for pathmasters, snow obstructions, artistic treatment of roads, and development of roads in Ontario. Under the head of town streets the subjects discussed are street improvement, choice of pavements, macadamized town streets, and form of specification for macadam streets. The plates show typical examples of good and badly managed roads, bridges, and road machinery.

STATISTICS.

Local taxation as affecting farms (*U. S. Dept. Agr., Division of Statistics Circ. 5, pp. 16*).—Investigations were made by this Department for the purpose of studying the possible effect of assessing cultivated and uncultivated lands alike. Special agents of the Department visited 1,114 selected farms in the extreme eastern and western sections of New York and obtained from "the owner of each farm his personal estimate of the market value of his entire visible property, separating the buildings from the land and also separating from the actual value of the land in its primitive form the value given to it by cultivation." The statistics thus secured are tabulated and discussed. The unimproved value of these farms is shown to be about 40 per cent of the improved value. Similar data obtained from Massachusetts show the unimproved value of land in cities to be about 58 per cent of its improved value. It is thus evident that if taxes were assessed on land at its unimproved value—its value without buildings, fences, drains, or cultivation—great advantage would accrue to the farmer.

Eighth Annual Report of Alabama College Station, 1895 (*Alabama College Sta. Rpt. 1895, pp. 32*).—A financial report is given for the fiscal year ending June 30, 1895, together with brief reports by the heads of departments on the work of the year, and an index of the bulletins and report of the station published during 1895.

Ninth Annual Report of Colorado Station, 1896 (*Colorado Sta. Rpt. 1896, pp. 80–191*).—A financial report is given for the fiscal year ending June 30, 1896, and a discussion by the director on the general management and present status of the station and substations, outlining work of the year, and giving a list of all bulletins and reports published by the station. Reports by the agricultural, horticultural, chemical, entomological, and meteorological and irrigation sections and of the superintendents of the San Luis Valley, Arkansas Valley, and Rainbelt substations, parts of which appear elsewhere, are also given.

Annual Report of Florida Station, 1896 (*Florida Sta. Rpt. 1896, pp. 95*).—This includes the reports of the director and heads of departments at the home station and of the superintendents at De Funiak and Myers substations on the work of the year, parts of which appear elsewhere, and a financial statement for the fiscal year ending June 30, 1896.

The farmers' interest in finance (*U. S. Dept. Agr., Division of Statistics Circ. 3, pp. 15, map 1, dgm. 1*).—This gives tabular data compiled largely from the Eleventh Census report showing the population, education, wealth, etc., of the States voting at the last Presidential election for the maintenance of the present gold standard and these voting for the free coinage of silver. Tables and diagrams are also given showing the gold value of corn, hay, wheat, and silver for the years 1868–'95, and a discussion is given of the causes affecting the fluctuation of agricultural prices and on the relationship between the prices of wheat and silver.

Cereal crops of 1896 (*U. S. Dept. Agr., Division of Statistics Circ. 6, pp. 12*).—"A report upon the 'Cereal crops of 1896,' covering the quality and distribution of the corn, wheat, and oats grown in the United States during the past year, returns from elevator and mill correspondents, also an estimate of the wheat crop of the world and a report from the European agent upon the general farm conditions prevailing throughout the East."

The cotton crop of 1896 (*U. S. Dept. Agr., Division of Statistics Circ. 7, pp. 4*).—Estimated crop and movement by States and Territories and the comparative mill purchases, etc., for 5 months, 1895–'96, and 1896–'97.

Crop report for May, 1897 (*U. S. Dept. Agr., Division of Statistics, Rpt. 148, n. ser., pp. 4*).—A report showing the condition of winter grains and spring pasture and meadows and the progress of spring plowing and cotton planting, with the contemplated acreage of cotton. The report of the European agent is given.

Crop report for June, 1897 (*U. S. Dept. Agr., Division of Statistics, Rpt. 149, n. ser., pp. 4*).—Crop conditions for the month, with notes on foreign agriculture and a report by the European agent.

Crop report for July, 1897 (*U. S. Dept. Agr., Division of Statistics, Rpt. 150, n. ser., pp. 8*).—Reports on the condition of field crops, with comparison of similar data for previous years and tables showing acreage and condition of growing crops, July 1, 1897.

Michigan crop report, May, 1897 (*No. 187, pp. 1–4*).—The condition of the crops and the amount of wheat marketed since August 1, 1896, are given.

Proceedings of the tenth annual convention of the Association of American Agricultural Colleges and Experiment Stations (*U. S. Dept. Agr., Office of Experiment Stations Bul. 41, pp. 118*).—This gives the proceedings of the convention held at Washington, D. C., November 10–12, 1896. In addition to the general business and discussions, the following papers are given: "Agricultural education," J. Hamilton; "What should be taught in our colleges of agriculture," G. T. Fairchild, H. H. Goodell, H. J. Waters, and H. C. White; "The exodus from the Farm; what are its causes and what can the colleges of agriculture do to nourish a hearty sentiment for rural life," I. P. Roberts and E. Davenport; "Chemistry for technical and practical students," H. A. Huston; "Should milk be sold on the basis of quality?" E. B. Vorhees; "How shall selling milk on the basis of quality be accomplished in the retail trade?" C. C. Georgeson; "What is the most profitable way to dispose of skim milk?" J. L. Hills; "Vegetable physiology in agricultural colleges," G. E. Stone; "Laboratory work in horticulture," E. S. Goff; "Systems of record keeping in experimental horticulture," L. C. Corbett; "Education in mechanical engineering and in the mechanic arts," R. H. Thurston; and "Engineering experiment stations," W. S. Aldrich. An account of the convention has already been given (E. S. R., 8, p. 541).

Crops and live stock in Ontario (*Ontario Bureau of Industries Bul. 61, pp. 8*).—Data for temperature and precipitation and information concerning the condition of crops, live stock, etc., are summarized from returns received from over 500 correspondents throughout Canada under date of May 1, 1897.

Guide to the Central Experimental Farm [Ottawa, Canada] (*1897, pp. 14, map 1*).—A guide for 1897, with a plan showing the location of the buildings with particulars of the arrangement of different crops and experimental plats.

Exports of cotton from Egypt, F. H. HITCHCOCK (*U. S. Dept. Agr., Office of Experiment Stations Bul. 42, pp. 29–34*).—Statistical information concerning the quantity, value, and average export price of cotton exported from Egypt from 1874 to 1895; the quantities and values of cotton shipped from Egypt to various countries, including the United States, during recent years, and the quantity of cotton imported into the United States from the principal sources of supply during the fiscal years 1875 to 1896.

Agricultural statistics of Tasmania (*Agr. Gaz. Tasmania, 4 (1897), No. 12, pp. 189*).—Statistics relating to the principal crops and live stock for 1896. The statistics for 1895 are given for comparison.

The wheat harvest of New South Wales (*Agr. Gaz. New South Wales, 8 (1897), No. 4, pp. 204–207*).—A comparative statement of the total area cultivated and the area and yield of wheat for the years 1895–'96 and 1896–'97. Tables give complete returns of the wheat crop in the counties of the coastal districts for the year ending March 31, 1897.

The production of Swedish agriculture, P. E. FAHLBECK (*Det svenska Jordbrukets Afkastning. Lund, 1893, pp. 100*).—With a summary in French.

Agriculture in Norway, 1896 (*Norsk Landmansblad, 16 (1897), pp. 1–3*).

Report of the Department of Agriculture of Norway for 1895 (*Aarsberetning ang de off. Foranstaltninger til Landbrugets Fremme. Christiania, 1896, pp. LXV, 320*).

The Classen Agricultural School at Näsgaard, Denmark (*Ugeskr. Landm., 41 (1896), pp. 325–330*).—The first article in a series describing Danish agricultural schools, their history, plan of instruction, attendance, etc.

Agricultural School at Odense, Denmark (*Ugeskr. Landm., 41 (1896), pp. 351–354*).

Report of Mustiala Agricultural and Dairy Institute for 1894, G. GROTENFELT (*Helsingfors [Finland], 1895, pp. 87*).

A poultry school in France, E. BROWN (*Jour. Roy. Agr. Soc. England, 3. ser., 8 (1897), II, No. 30, pp. 249–258*).—An account of the poultry school at Gambais, Seine-et-Oise, France.

Some books on agriculture and agricultural science, A. C. TRUE (*U. S. Dept. Agr., Office of Experiment Stations Circ. 31, pp. 176*).—This gives a list of about 1,500 books published during the past 3 or 4 years in this and other countries.

The farmers' and fruit growers' guide, W. H. CLARKE (*Sidney: William Applegate Gullick, 1897, pp. 468, figs. 100, pls. 15, maps 4*).—This is a handbook on agriculture and kindred subjects, issued under the auspices of the Department of Mines and Agriculture of New South Wales. "The matter has been gleaned for the most part from articles that have appeared in the Agricultural Gazette, and an effort has been made to confine the information to methods and crops that have stood the test of practical trial from season to season, not only by the Department staff of experimentalists, but by a large number of enthusiastic agriculturists throughout the Colony who have coöperated with the Department in determining the merits of the systems of culture advocated."

There are chapters on climate, soil, manures and manuring, rotation of crops, sheep raising, irrigation, conservation of fodder and the value of food stuffs, clearing, fencing, and preparation of land, cultivation of different crops under varying climatic conditions, fruit culture, viticulture, farming, dairying, pig raising, poultry keeping on farms, and bee keeping, besides an appendix giving data on miscellaneous agricultural topics.

Work and expenditures of agricultural experiment stations, A. C. TRUE (*U. S. Dept. Agr., Office of Experiment Stations Circ. 29, pp. 4*).—This gives the views of the Department on certain matters affecting the management and expenditures of experiment stations established in accordance with the act of Congress, March 2, 1887.

Permanent elements in experiment station work, A. C. TRUE (*U. S. Dept. Agr., Office of Experiment Stations Circ. 30, pp. 4*).—Reprinted from the Proceedings of the Ninth Annual Convention of the Association of American Agricultural Colleges and Experiment Stations (E. S. R., 8, p. 537).

Report of committee on methods of teaching agriculture (*U. S. Dept. Agr., Office of Experiment Stations Circ. 32, pp. 20*).—This report, with a paper on "Some features of European institutions for agricultural education" by A. C. True, and "Notes on agricultural education in the Scandinavian countries" by F. W. Woll, was presented to the Association of American Agricultural Colleges and Experiment Stations at the convention held in Washington, D. C., November 10–12, 1896. The entrance requirements and courses of study in the Technical High School at Munich, Germany; The Agricultural Institute at Gembloux, Belgium; and The National School of Agriculture at Grignon, France, are given in an appendix.

NOTES.

Arizona University and Station.—Howard Billman has resigned his position on the board of regents and as president of the university, the latter to take effect December 15, 1897, and Ex-Governor L. C. Hughes has been appointed to fill the vacancy on the board and as chancellor of the university. By reason of his appointment as superintendent of public instruction A. P. Shewman becomes a member of the board of regents, *vice* T. A. Dalton, and E. W. Freeman has been appointed a member of the board, *vice* Selim M. Franklin.

Connecticut Storrs Station.—J. S. Judd has resigned as secretary of the station and the vacancy has been filled by the election of D. W. Colby, formerly of the Maine Experiment Station. W. L. Pentecost has resigned as assistant agriculturist of the station and J. N. Fitts has been elected to the position of assistant in the farm experiments.

Florida College and Station.—W. F. Yocum, A. M., D. D., has been elected president of the college and director of the station, *vice* O. Clute, resigned. H. E. Stockbridge, Ph. D., has been appointed agriculturist of the station.

Idaho Station.—L. F. Henderson, botanist, and F. A. Huntley, horticulturist, are making a somewhat careful survey of the State of Idaho with reference to the fruit interests, trying to determine the reasons for the extensive injury to orchards due to the cold wave at Thanksgiving time, 1896. At that time many orchards were utterly ruined, while contiguous orchards were intact, and in many instances the hardy varieties were injured while the tender varieties were uninjured. A careful study of the fungus diseases is also being made, and a thorough examination of the noxious weeds. Mr. Huntley has made a large collection of photographs of representative orchards and typical trees in both normal and pathological conditions, and of weeds and weed tracts. In this work the railroads and horticulturists of north and south Idaho have coöperated cordially, and the impression produced by these men visiting from orchard to orchard among the farmers and orchardists was very favorable to the experiment station. A great amount of valuable data has been secured, both for future reference and for publication.

New York Cornell Station.—L. H. Bailey, horticulturist, spent the past summer in Europe, making a special study of the problems relating to horticulture. Sugar-beet culture is receiving special attention in New York, and the station is coöperating with several hundred farmers of the State in the work.

Oregon College and Station.—Thomas M. Gatch has been elected president of the college and director of the station, *vice* H. B. Miller. George Coote, formerly assistant horticulturist, has been elected horticulturist, *vice* U. P. Hedrick, and D. W. Trine, assistant botanist, has resigned his position.

South Carolina College and Station.—Rev. H. S. Hartzog has been elected president of the Clemson Agricultural College and director of the station, *vice* E. B. Craighead, resigned, and J. S. Newman has been elected professor of agriculture in the college and vice-director and agriculturist of the station, *vice* W. J. Quick, resigned.

South Dakota College and Station.—The newly appointed board of regents is as follows: President, H. H. Blair, Elk Point; secretary, Robert W. Haire, Aberdeen; Charles N. Herried, Eureka; L. M. Hough, Sturgis; Frederick A. Spafford, Flandreau.

TEXAS COLLEGE AND STATION.—The board of directors was reorganized July 1 as follows: President, A. J. Rose, Austin; secretary, W. R. Cavitt, Bryan; George C. Pendleton, Belton; F. P. Holland, Dallas; F. A. Reichardt, Houston, and Charles Rogan, Brownwood. A. M. Soule has been relieved of his duties as assistant agriculturist of the station, but will retain his position as assistant professor of agriculture at the college. B. C. Pittuck has been appointed agriculturist of the station and relieved of all college work. He will also take charge of the Beeville Substation, under the supervision of the director. Mr. C. C. Todd has been made assistant chemist of the station.

UTAH STATION.—Paul Fischer, veterinarian and entomologist, has resigned and accepted the position of veterinarian at the Kansas Agricultural College. F. C. Sears has resigned his position as horticulturist and botanist of the station. At the April meeting of the board of trustees Joseph E. Wilson, of Logan, was appointed secretary, *vice* Joseph E. Hyde.

VERMONT STATION.—W. A. Orton has been appointed assistant botanist at the station.

WISCONSIN UNIVERSITY AND STATION.—J. A. Jeffery, formerly assistant in the North Dakota College and Station, has been appointed assistant professor of agricultural physics at the university. Alfred Vivian has been chosen assistant in agricultural chemistry at the station.

EXPERIMENT STATION RECORD.

VOL. IX. NO. 4.

The report of the section on agriculture and chemistry presented to the Minneapolis Convention of the Association of American Agricultural Colleges and Experiment Stations (see p. 303) deals with a matter of very great importance to our agricultural experiment stations. The subject has already been much discussed at meetings of station officers and elsewhere. As a rule, however, the discussion follows theoretical lines and often loses sight of the pertinent facts as brought out by the actual condition of our agricultural colleges and experiment stations. Some points on which those who criticised the report of the committee at Minneapolis laid especial stress are quite generally admitted as true in a general way, but concerning their application to the question in debate there is apparently much misunderstanding. The interrelation of the college and station as provided by the Hatch Act is commonly regarded as a thing which naturally strengthens both instruction and research in the institutions benefited by that Act. The need and demand of the American farmer for general information regarding what experimental science has already discovered to be the means for improving his practice is conceded on all hands. The advantage which may accrue to the investigator from personal contact with the practical farmer or the inquiring student is without doubt very considerable, within certain bounds. And indeed after all it resolves itself into a question of "metes and bounds." It is doubtful whether anyone will at this late day defend the proposition that the station officer ought to be a "man of all work," even in any one line of agricultural science. Certainly the Hatch Act makes it very plain that the prime business of the stations is to investigate. Now the investigator may easily add to his primary functions those of a secondary character, and act as a teacher, lecturer, or ready-reference-information monger. The real question is how far can he go in this secondary business without injuring his ability and success as an investigator. After careful inquiry and personal examination of the conditions existing at our stations we are prepared to answer this question so far at least as to affirm without fear of successful contradiction that the investigator can not act so much as teacher, lecturer, and information monger as he is actually doing at many of our stations without seriously impairing his usefulness as an investigator. Four or five hours a week in the class room or laboratory with advanced students may be a most inspiring thing for a station investigator, but it is a far different matter when he must follow the routine of more or less elementary instruction in some general science twelve or fifteen hours a week. In the latter case he will be a rare man indeed who is not so wearied by his duties as a teacher that he will not be able to do his best work as an investigator. He may accomplish considerable useful work for the station, but it will probably be of comparatively low grade. A half dozen lectures and quizzes at farmers' institutes in a season may correct the theories of investigators and reveal to them in a new light the real problems of the farmers; but a three months' campaign in the lecture field is most likely to seriously diminish the stock of energy which is necessary to solve these problems by experimental inquiry, and seriously interferes with planning and work. An occasional letter or leaflet on some familiar topic to satisfy the earnest desire of the farmer correspondent for live information may refresh our investigator's mental powers, but the dull grind of a voluminous correspondence or popular composition will most surely sap his alertness in the pursuit of new truth.

We can forgive much that is past in the history of our stations because of popular pressure and financial stress, but we believe that unless boards of management and executive officers take a firm stand to protect the investigators against the inroads on their time and energies in other directions which have hitherto been permitted the stations will never measure up to the best which they might easily do, to say nothing of their meeting the requirements of the Federal statute under which their operations are largely conducted.

One of the greatest of living American educators has recently said: "Anyone who has learned how hard it is to determine a fact, to state it accurately, and to draw from it the justly limited inference, will be sure that he himself can not do these things except in a very limited field. He will know that his own personal activity must be limited to a few subjects if his capacity is to be really excellent in any. He will be sure that the too common belief that a Yankee can turn his hand to anything is a mischievous delusion. Having as the result of his education some vision of knowledge and capacity needed in the business of the world, he will respect the trained capacities which he sees developed in great diversity in other people; in short, he will come to respect and confide in the expert in every field of human activity. Confidence in experts and willingness to employ them and abide by their decisions are among the best signs of intelligence in an educated individual or an educated community."

The American farmer, through the National Congress, has provided himself with the means for employing at least a limited number of first-class experts to aid him in the solution of numerous and difficult problems which forever harass him. Shall he have such experts, or must he be obliged through a practical diversion of the funds for investigation to put up with second-class work and unsatisfactory answers to his inquiries? Thus far he has not received the best which he might have had for his money.

ELEVENTH ANNUAL CONVENTION OF THE ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.

W. H. Beal,
Office of Experiment Stations.

The eleventh annual convention of the Association of American Agricultural Colleges and Experiment Stations was held at Minneapolis, Minnesota, July 13–15, 1897. About 150 delegates and visitors were present, representing 39 States and Territories, the Department of Agriculture, England, and the Dominion of Canada. The States and Territories not represented were Idaho, Illinois, Louisiana, Oklahoma, Pennsylvania, Tennessee, and Virginia.

GENERAL SESSIONS.

The convention was called to order by the president, G. T. Fairchild, of Kansas, and prayer was offered by J. E. Stubbs, of Nevada.

The report of the executive committee was submitted by the chairman, H. H. Goodell, of Massachusetts. It briefly reviewed the work of the committee during the year and made a number of recommendations, the more important of which are noted later in this account.

The report of the treasurer, J. H. Washburn, of Rhode Island, showed a balance in the treasury of the Association of $418.58. The annual dues remain the same as in previous years, namely, $10 for each member of the Association.

W. H. Jordan, of New York, submitted the report of the section on agriculture and chemistry. This report was devoted principally to an argument to show "that the instructional effort is absorbing a share of the time and energy of the various agricultural faculties and station staffs which is disproportionate to the funds provided, and that, taking the country as a whole, it has overshadowed the effort at investigation and has really encroached upon the time and means belonging to it."

Data furnished by replies from 35 stations to a circular of inquiry were cited to show that while these stations have 321 persons on their staffs the time of the latter is so occupied with instructional duties that their *one-man value for station purposes* is only 208, including 65 of the assistant grade. It was maintained that where instruction and investigation are combined if either phase of the work suffers it is generally the investigation. "Teaching is a task which must be met at appointed times, enforcing preparation which in science laboratories is extensive, and involving that expenditure of nervous energy which good instruction peculiarly demands. Interruptions are at the expense of inquiry work, and if weariness comes investigation suffers rather than teaching." A result of this condition of affairs, it was stated, is that a large part of the time of the officers of these institutions is being devoted to working over and applying the known facts of science, and the search for new facts is being largely abandoned. Much of the time of station men is also being taken up in public addresses, etc., work which is strictly instructional and properly belongs to the colleges. While a certain amount of compilation work and institute work was regarded as commendable, it was considered doubtful whether it should be given the attention which it is receiving at present by many station officers.

"It may be profitable for those who are the responsible administrators of the generous Government aid to inquire whether the research effort is fairly treated; whether, after all, busy teachers are the most efficient instruments for investigation, and whether it is not time for us to more rapidly replenish the fountains of knowledge from which we are so freely drawing to satisfy a hungry public. . . . If our experiment station workers were more independent, and if they were giving more intense and more continuous attention to a less number of problems, our real progress would be more rapid, and ultimately the popular verdict would ratify our policy."

I. P. Roberts, of New York, in discussing this report, said: "My experience leads me to the conclusion that the principal object of the experiment station is to diffuse knowledge of improved methods, and secondarily to carry on the work of investigation simultaneously."

C. E. Thorne, of Ohio, stated that he had found personal contact with the farmers at farmers' institutes one of the strongest factors in keeping the station in that close touch with the farmers which is necessary at the present stage of station work.

R. J. Redding, of Georgia, thought the great need was to get the farmers to make the proper application of what is now generally known and accepted by intelligent agriculturists. "The illustrative work done by the stations is very important. It puts the farmer in close touch with us. It does not interfere with the investigation work proper. It may be both investigative and instructive."

O. Clute, of Florida, favored the coördinate development of both educational and investigation work.

A. Ellis, of Colorado, said: "I do not find in practice that the union of the experimenter and the instructor is at all detrimental to either phase of the work. I am inclined to think that the man who separates himself from the practical affairs about him, who holds aloof from farmers' institute work and keeps himself in the laboratory, will lose some of the powers and force of his investigations and be in danger of becoming a visionary or a theorist. . . . Our farmers are calling on us as leaders in agriculture to give them something that is practical."

B. C. Buffum, of Wyoming, thought the key to the situation lay in popularizing the bulletins.

W. M. Hays, of Minnesota, suggested that possibly the way to solve the question was to hold the station funds to experimental work and get more money for the popular work.

The chairman of the section on horticulture and botany was absent, but a report prepared by him on the work of that section during the year was read by H. H. Goodell. This report was based principally upon replies to a circular of inquiry sent out to botanists and horticulturists by the chairman. These replies show a very encouraging extension of the work in these fields. Increased attention is being given to the equipment of the different institutions, especially for physiological investigations. A list is given of the subjects under investigation in these fields in the different colleges and stations, and it is pointed out that these investigations are very largely of local interest. It is urged that "much good could be accomplished if some of the problems of general interest to great sections of the country were taken under consideration by groups of botanists or horticulturists in the same systematic manner adopted by the General Government in the study of food products, etc. Such topics as improvement of seeds; diseases of plants, such as corn, cotton, wheat, etc.; improvement of native plants for food; selection and improvement of corn, and improvement of cotton are of general interest to large portions of the United States, and systematic work on these subjects by a number of the experimenters, under direction of preconcerted plans, will yield large and valuable results." During the eight months covered by this report the botanists issued 23 bulletins aggregating 804 pages and the horticulturists sent out 41 bulletins containing 1,227 pages, or a total of 2,031 pages.

The report of the section on entomology was presented by A. D. Hopkins, of West Virginia. This report briefly discussed the progress which has been made in teaching entomology and in entomological investigations and pointed out the need of improvements in this line, especially the importance of improved text-books and reference books and methods of teaching.

"While the progress that has been made in the entomological work of the stations in the line of original research is gratifying, it is not what one would be led to expect from the ample facilities found in the thoroughly equipped laboratories, libraries, and men at most of the stations having an entomological department. This lack of progress, it is plain to be seen, is not for the want of subjects demanding investigation or of suitable men and equipment to carry on the work. In most cases it is due to the limited time and energy available for this class of work. It appears that some so-called experiment station entomologists are required to devote all of their time and energies to teaching and routine station duties, or it must be divided between a number of distinct departments of both college and station work. . . . It is plain that no progress can be made in original investigations when this state of affairs exists. . . . There are teachers and there are investigators, and if we would have rapid progress in the subjects pertaining to the duties of both it is evident that the teacher should devote his time to college work while the investigator should have all of his time to devote to regular station work and as much as possible to original research."

Attention was called to the benefit that both technical and economic entomology has derived from the work of different associations. The history of the section on entomology was briefly reviewed and it was stated that the prime cause of the waning interest in the work of this section—

"is possibly found in the fact that the same class of subjects is discussed at our section as is presented to the Association of Economic Entomologists which meets at another time and place. Therefore entomologists who can not attend both prefer to attend that of the Association of Economic Entomologists, where they meet a greater number of entomological friends and workers and at the same time have an opportunity to attend the sectional meetings of the American Association for the Advancement of Science and those of affiliated societies with which the economic entomologists hold joint sessions. . . . When we consider the clearly specified business of the Association of Economic Entomologists, its work and results, it would seem that the only special line of subjects left to the entomologists who attend the sessions of the Association of American Agricultural Colleges and Experiment Stations is that of methods in teaching technical and economic entomology and of conducting investigations which have a direct bearing upon the work of the teacher and his students. It would appear, therefore, that if this Association is to contribute in the future to the material advancement of economic and technical entomology in the college and station it might be best accomplished through the work of committees appointed to determine and report upon methods of teaching entomology in the various agricultural colleges of the world."

The report of the committee on indexing agricultural literature was read by A. C. True, of this Department. This report recommended the following plan for indexing agricultural literature:

"*Scope.*—The works indexed should comprise such works in the English language as treat specifically of agricultural subjects, or of the direct application of the sciences to agriculture.

"*Selection of books.*—There should be carefully selected, with the assistance of competent experts, a list of, say, 1,000 books of the character above noted. These should be fully catalogued, giving information as to the publisher and cost, and, in fact, every detail which would make the catalogue useful, with notes where necessary. This catalogue should be published and in sufficient number to allow of its being quite widely distributed. The books should be collected and the cataloguing done by the Library of the Department of Agriculture, since a large proportion of the books are already on the shelves of the Library, and the facilities for obtaining information along this line are the best.

"*Indexing.*—The indexing should be done, one division of agriculture at a time, by getting together the books on this subject and carefully going over them in detail. The entries should be made on slips of paper of uniform size and arranged under some carefully planned system. When the literature of one subject is exhausted, these slips can be edited and a new subject undertaken. When the whole ground is covered the slips should be carefully edited and a fair copy made for the printer. . . .

"Your committee respectfully submits the following resolution and urges its adoption at this convention:

"*Resolved,* That this Association cordially indorses the plan for the preparation of an index of agricultural literature by the U. S. Department of Agriculture as set forth in the report of the committee on indexing agricultural literature, and the executive committee is hereby instructed to take such measures as will in its judgment best promote the speedy and efficient carrying out of this plan—

"That a committee of five, including the Librarian of the Department of Agriculture, be appointed to act as an advisory committee in the selection of the books to be indexed and in the working out of other details of the index."

H. E. Armstrong, of London, England, chairman of the committee of the Royal Society on an international index of scientific literature, commended the suggestions of this report, and referred briefly to the contemplated work of the Royal Society.

The plan outlined in the report was indorsed by the Association and the chairman appointed the following committee: W. M. Hays, T. F. Hunt, E. Davenport, A. C. True, and W. P. Cutter (Librarian of the U. S. Department of Agriculture).

The report of the bibliographer, A. C. True, briefly noted the progress which had been made in the collection, cataloguing, and indexing of agricultural publications in the Department since the last convention. "Excluding Government publications and publications of societies, there have been received at the Library of the United States Department of Agriculture since the issue of Circular No. 31 of the Office of Experiment Stations, entitled 'Some Books on Agriculture and Agricultural Science,' something over 700 books and pamphlets relating to agriculture." In addition to the special bibliographical work of the Library of the Department and of the Experiment Station Record, and the card index of experiment station literature, it is proposed in the future "to publish from time to time notices of books on agricultural subjects by combining the lists given in the Department Library accession bulletins with such statements regarding the character and contents of these books as can be prepared in the Library and the Office of Experiment Stations."

The report of the special committee on codification was read by the chairman of the executive committee. This report is a compilation of all important resolutions, etc., adopted by the convention since its organization, topically classified. The report was accepted and ordered to be printed, together with the constitution, in one pamphlet.

The report of the committee on uniformity in station nomenclature was submitted by H. P. Armsby. This report lays down certain general rules regarding the naming of the parts of plants, the use of common names, the nomenclature of fungi, and the stating of the ingredients of Bordeaux mixture, and defines the terms nodule (tubercle), pollination, fecundation, fertilization, sterile, sterilized, and pasteurized.

The report, after amendment, was accepted.

The following resolution, referred to the executive committee at the last convention, was adopted on recommendation of this committee:

Resolved, That this Association recommends that the publications of each station for the year be paged consecutively, and that there be appended to the annual report or the final publication for the year a title page and an alphabetical index of subjects similar to that in the Experiment Station Record.

The executive committee was ordered to take the necessary steps toward securing legislation for the issuing of uniforms by the Government to the various colleges.

The special committee on revision of the constitution of the Association submitted a report suggesting two forms of revision. The first, approved by the majority of the committee, and of those with whom the committee conferred—

"proposes the abolition of all sections, so that if adopted the annual convention of the Association would thereafter be a meeting of the executive officers of colleges and stations with such other and special delegates as the institutions respectively saw fit to send to these conferences. It is believed by those favoring this plan that it will effectively bring the Association back to its original purpose, namely, the consideration in annual conference of the problems of college and station administration as affecting (*a*) internal working, (*b*) relations to the Government of the United States, (*c*) relations to the State governments respectively, (*d*) relations to other institutions, and (*e*) attitude towards new legislation proposed from time to time. . . .

"While concurring in the main with the conclusions of the majority as already set forth, the minority of your committee believes that no other suitable organization exists to bring together for beneficial conference the teachers of agriculture and horticulture and the sciences as applied thereto with the station investigators in those lines. Therefore it is proposed as an alternative to the plan and recommendations of the majority to so revise the constitution of the Association as to provide for three sections: (1) On college and station work and administration, (2) on agriculture and the sciences applied thereto, and (3) on horticulture and the sciences applied thereto."

The verbal changes in the present constitution necessary to carry into effect either of these plans is pointed out in the report.

The Association directed that provision be made for discussion of these propositions at the next convention.

The second report of the committee on methods of teaching agriculture[1] was submitted by A. C. True. This report was accepted and the committee continued.

The annual address of the president, G. T. Fairchild, of Kansas, discussed in a scholarly manner the evolution of agricultural education under three main heads—education for agriculture, education in agriculture, and education by agriculture.

"[In the first of these three stages] the professor's instruction was necessarily a body of information—historical, accounting for habits and practices; demonstrative, illustrating the best practice from cullings of reports, addresses, and descriptions of travel—in fact, it was a great deal about agriculture, with little of it. The elevation of mind in the man was still to be cared for by a solid training outside of the art to be taught. . . . Moreover, the very body of information was a matter of dispute. The professor was charged with incompetency. His crops were said to be inferior; his specimens of stock for illustrative purposes were said to be not types; his instructions were not applicable to the pioneer farming to which his pupils were accustomed; his methods were extravagant; in short, his farming was

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[1] See U. S. Dept. Agr., Office of Experiment Stations Circular 37. For first report see Bulletin 41, p. 57, and Circular 32 of the same Office.

an exponent of theory rather than the practice of the thrifty farmers who criticised him. . . .

"[In the second stage, education in agriculture] men of science began to find illustrations of chemical reactions in the processes of vegetation and growth as well as in farm methods. The chemistry of feeding and the physiology of breeding began to have interest as studies of both nature and practice. The introduction of farm machinery enlarged the application of mechanics. Comparative anatomy and physiology aroused new interest in domestic animals and their development. The studies of Darwin made the story of both plants and animals under domestication especially interesting. Methods of teaching the sciences took on more of laboratory character, to their great advancement as disciplinary studies. The development of horticulture into a specialty for large portions of our country, the adoption of intensive farming with the growth of better markets, the enormous extension of the cattle interest with the opening of great packing houses, and withal the general thrift of the whole community aroused a new interest in education for the industries of all kinds. So the agricultural schools became centers of a new enthusiasm."

Experimentation in agriculture began to receive increased attention, and men were selected and trained with the special object of the extension of this ideal. College and university courses in agriculture were provided and "specialists in every line of investigation were called for and produced, sometimes on short notice, but with earnest desire to furnish genuine training and information in agriculture and related sciences. The few colleges already past the stage of mere information for agriculture and reasonably well equipped for research became the sources of immediate supply for station workers and professors, so that education in agriculture was at once brought into prominence."

In the third stage, hardly yet entered upon, the problem is, "How shall men of toil find elevation by their toil as well as in it?" Farmers' institutes, the distribution of public documents, and the Chautauqua Circle of Science were discussed as a means of solving this problem, but obstacles in the way of the success of all of them were pointed out.

"If, then, neither the schools of agriculture, the institutes, the elementary texts, nor the reading circles furnish the full solution for our problem, whither shall we look? Must we give up the task and be satisfied to have an aristocracy of learning who shall rejoice together over the grand enlightment of our little circle while the 'hewers of wood and the drawers of water' render stalwart service under our exalted direction? There are highly educated men and trained scientists who accept this condition as final and rejoice in such a reign of caste; but you and I stand as exponents of scientific liberal education for the industrial classes. . . . We must solve the problem of combining learning and labor without confining the learning to the top stratum. A real civilization requires it, and requires it of us. I think we are ready for the third stage of our evolution in education by agriculture."

The starting point of the system of education by agriculture or natural training it was believed must be in the general courses for agricultural schools, then courses for county teachers' institutes might be provided.

"With the body of teachers secured through agricultural colleges and well-developed normal schools, I would have ready for their use a collection of text-books framed for the work of developing ingenuity of thinking in children, with all the material close at hand."

This idea was elaborated at some length, concluding as follows:

"Now is the time to work through voice and press upon the ear of the people. The teachers are already inquiring for a more thoughtful course of study. The leaders are asking if nature studies and culture studies may not be combined. Some States are attempting genuine reforms in the advancement of rural schools. Why should we not join forces with this reform and give it a definite aim by asking for a genuine education for agriculture, in agriculture, and by means of agriculture itself?"

On motion of J. E. Stubbs, of Nevada, the following resolution was adopted:

Resolved, That we, the members of this Association, have listened with deep satisfaction to the address of President G. T. Fairchild on the evolution of agricultural education, and that we desire herewith to express to him our high personal esteem and also to honor his long, distinguished, and inspiring service to the cause of education, especially in the field of agriculture.

A resolution was adopted which requested the executive committee "to take such steps as by legislation or otherwise will create each of the land-grant colleges a depository of all Government publications, including all past publications, as far as possible."

A. Cope, of Ohio, offered the following resolution having a similar bearing, which was adopted:

Resolved, That a committee of five be appointed by the president to investigate, consider, and if practicable devise a plan whereby graduate students of the land-grant and other colleges may have access to, and the use of, the Congressional Library and the collections in the Smithsonian Institution, the National Museum, and the scientific bureaus of the various Departments at Washington of the U. S. Government, for the purposes of study and research, said plan to include suggestions as to the manner in which such work may be organized, coördinated, and directed to the best advantage; the composition and organization of such a staff as may be necessary to properly coördinate and direct such work, and also an outline of such legislation as may be necessary to effect the general purposes of this resolution; said committee to report at the next meeting of the Association.

This matter was referred to the following committee: A. Cope, M. H. Buckham, C. Northrup, A. Ellis, G. E. MacLean, and J. H. Washburn.

On the recommendation of the section on mechanic arts a committee of five was appointed to formulate a measure to be submitted to Congress providing for the establishment of engineering experiment stations in connection with the land-grant colleges. The members of the committee were C. S. Murkland, W. S. Aldrich, C. W. Hall, A. W. Harris, and J. E. Stubbs. Later this committee through its chairman, C. S. Murkland, made a report which contained a draft of a bill to be submitted to Congress establishing engineering experiment stations in every State and Territory and appropriating $15,000 to each for the maintenance of such station.

Messrs. S. M. Emery and W. A. Henry opposed the recommendations of this report. C. E. Thorne thought that the fostering of our engineering facilities was sufficiently provided for in the patent laws. A. W. Harris denied that mechanic arts had been sufficiently cared for by the patent laws and advocated the recommendations of the committee in order that mechanic arts should be provided for as fully as agriculture in the colleges. The report was adopted by a vote of 18 to 11.

M. A. Scovell, of Kentucky, presented a memorial asking the Secretary of Agriculture to accept, keep on file, and if possible compile the records of the committee appointed in 1893 to assist in conducting test of dairy breeds at the World's Fair. These records, he explained, were still in the possession of the chairman of that committee, and though efforts had been made to get them printed, the cost (estimated by the Public Printer to be $70,000) stood in the way. The question of printing, however, was not raised in the memorial, which simply requested that the records be kept on file and available.

S. M. Emery, of Montana, called attention to the existence of a feeling of antagonism between the agricultural papers and the experiment stations and urged the importance of disarming such feeling.

W. R. Lazenby, of Ohio, presented the report of a committee on uniform methods of seed testing, which embodies specific rules and recommendations for this work adopted by the committee at Washington, D. C., January 20, 1897.[1]

A paper on advertising in station publications was read by A. C. True. In this paper it was held that the general rule of management which governs public institutions applies to the experiment stations, *i. e.*, "that they are to be conducted impartially for the public good and in such manner as not to intentionally favor particular private parties or enterprises." The functions of these stations are limited also by the provisions of the Hatch Act, which was not intended "to establish general bureaus of information on agriculture but institutions devoted to experimentation." It was admitted that the stations have been compelled to do a great deal of work of this kind, but it was considered a great mistake to favor or maintain such work indefinitely, and the stations should strive to have their business restricted to its legitimate channel. Of course exceptions must be made in case of those stations supported in part by State funds which are charged with certain police duties, such as the inspection of fertilizers, dairy products, nursery stock, etc.

"Such work necessarily brings a number of private commercial establishments under public control and limits the liberty of such establishments in definite directions. . . . The establishments deprived of perfect liberty in their action are entitled to the compensatory advantage of public guaranty of their business if satisfactorily conducted. This removes the published statements of analyses of commercial fertilizers and other inspected agricultural materials from the ordinary category of advertisements."

The publication of the results of formal tests of different farm implements and apparatus is also removed from this category, but it was held that these tests should be so conducted as to thoroughly remove all suspicion of unfairness or incompleteness.

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[1] See U. S. Dept. Agr., Office of Experiment Stations Circular 34.

"The real objection, however, to advertisements in station publications lies against the recommending of miscellaneous manufactured articles used by farmers which have not been the subject of experiment or investigation by stations in any true sense." Recommendations, based upon insufficient experimental data, reduce the station to a purveyor of miscellaneous information obtained more or less at haphazard, and which if proven incorrect may subject the institution to the charge of unfairness or favoritism.

"This is of course a practical question, and we must not draw too fine distinctions, but I am persuaded that in almost every case where advertising has been introduced into station publications statements more or less general in character would have answered just as well and the charge of favoritism have been avoided. Even in the matter of illustrations a little ingenuity will secure the publication of the information which is really desirable without the use of the cuts furnished by the manufacturers."

A. W. Harris, of Maine, representing the committee appointed on the collective exhibit at the Paris Exposition, reported as follows:

"Your committee, appointed to consider the desirability of a collective experiment station exhibit at the Paris Exposition, and to recommend a plan for its preparation and care, beg leave to report that they have considered carefully the matters referred to them and are of the opinion (1) that a collective experiment station exhibit at the Paris Exposition is desirable, and (2) that such an exhibit is practicable provided the Association can obtain from the Office of Experiment Stations assistance in the preparation and care of the exhibit and in the payment of expenses upon a plan like that on which the Chicago exhibit was prepared, and your committee recommend (1) that the executive committee be directed to confer with the Honorable Secretary of Agriculture to determine what assistance the Department of Agriculture will give, (2) that a special committee of 5 persons be appointed, of whom the director of the Office of Experiment Stations shall be one, to prepare the exhibit, and (3) that the executive committee be instructed to pay the necessary expenses of the special committee."

C. Northrup, of Minnesota, called attention to the difficulty of making a satisfactory exhibit of the kind contemplated, pointing out that the smaller things might be exhibited with comparative ease, while it would be impossible to "exhibit the progress of intellectual life that is going on under the processes of education." The best work and best results could not possibly be exhibited. He stated that unless it could be shown (1) that we have something very desirable to exhibit and (2) that the results are likely to be compensating he should feel constrained to vote against the exhibit.

The views of J. H. Canfield, of Ohio, agreed in the main with those of the previous speaker. J. H. Washburn, of Rhode Island, and W. H. Jordan, of New York, expressed the opinion that this was largely a question of representation and that it was extremely desirable that the stations should be properly represented at the Exposition. A. C. True thought an exhibit feasible and desirable, and urged that there should be no delay in the appointment of a committee and the formulation of a plan.

The following committee was appointed: H. P. Armsby, W. H. Jordan, A. W. Harris, M. A. Scovell, and A. C. True.

H. W. Wiley, of this Department, delivered an address on the sugar-beet industry in the United States. He sketched the history of the manufacture of sugar from beets in France and its establishment in this country, displaying a series of lantern slides illustrating the sugar production of the world and of the United States, and the relative proportions of cane and beet sugar produced. Illustrations of the sugar beet itself were shown, and the process of manufacture was described in detail and illustrated by slides showing the machinery used in the various operations. He discussed the operation of the tariff laws as affecting the production of beet sugar, and outlined the probable extent of territory in the United States in which the growth of sugar beets would be profitable. He further stated that sugar making from beets on a small scale is not practicable.

In this connection G. H. Hicks, of this Department, called attention to a possible source of profit to the farmer in raising beet seed. Practically all beet seed is now imported and much of its vitality is lost in transit. He considered that the raising of sugar-beet seed might become an industry of some importance in this country.

W. H. Jordan, from the committee on farmers' institutes, submitted a report which stated that while the committee recognized "the great need of coördinating and digesting for popular use the mass of data bearing upon the practice of agriculture which has accumulated in recent years," it was not prepared to indorse the plan presented by J. Hamilton at the last convention, because there is at present a very hopeful activity in the writing of popular books on agriculture, and because the plan involves more time and expense than the Government would probably be willing to incur, and if undertaken would subject it to the criticism of competing with private business.

A paper on "An experiment, its conception and methods of procedure," was read by H. L. Bolley, of North Dakota. W. H. Jordan briefly discussed this paper, especially the portion relating to variety tests, and stated that, while he had no desire to defend the grosser forms of variety testing, he was of the opinion that large collections of varieties gave an opportunity for the study of certain general principles in botanical horticulture which could not as readily be obtained in any other way.

H. J. Waters, of Missouri, submitted a report from the section on agriculture and chemistry, calling attention to the recommendations relating to uniformity in fertilizer laws agreed upon by a committee of State inspectors of fertilizers at New Haven, Connecticut, March 9, 1897, and recommending that a committee of 5 be appointed to confer with a similar committee from the Association of Official Agricultural Chemists in regard to this matter. The committee appointed in accordance with this recommendation was H. J. Wheeler, H. P. Armsby, C. D. Woods, E. H. Jenkins, and M. A. Scovell.

G. H. Hicks submitted the following resolution relating to pure seeds:

Resolved, (1) That this Association earnestly recommends that some practical instruction in seed testing and seed investigation be offered at each of our agricultural colleges, and that the experiment stations equip themselves for investigations in seed testing, following so far as may be found practicable the rules and methods adopted by this Association and published in Circular No. 34 of the Office of Experiment Stations.

(2) Furthermore, we recommend that one or more lectures on agricultural seeds and the best means for ascertaining the real value of the same be given at our farmers' institutes, and that the importance of this subject be urged upon all suitable occasions.

(3) We heartily indorse the efforts of the U. S. Department of Agriculture, by means of its pure-seed investigations, to secure an improvement in the quality of agricultural seeds, and we recommend that the experiment stations and agricultural colleges coöperate with the Department in this work.

The following resolution on plant registration, reported from the section on horticulture and botany, was adopted by the Association:

Resolved, That we urge upon the U. S. Department of Agriculture the importance of extending its collections of fruits and other economic plants by the addition of specimens showing the foliage, flowers, or other parts, and of photographs showing typical trees or plants of all varieties offered for sale, in order to aid in the description of varieties and in the study of plant variation as well as to discourage the duplication of names and to secure due recognition to the originators of valuable varieties, and that there may be some one place where all varieties placed upon the market may be officially registered, numbered, and described.

The thanks of the Association were voted to the Commercial Club, of Minneapolis, and to the University of Minnesota for courtesies extended to the Association, and to President Hill, of the Great Northern Railway, for an invitation to visit the Red River Valley as guests of the railroad. Many of the delegates took advantage of the opportunity afforded by President Hill's invitation to visit this famous agricultural region.

In the course of the convention opportunity was afforded Prof. H. E. Armstrong, of London, England, to deliver the third biennial course of lectures on the experimental work at Rothamsted, as provided for by the Lawes Agricultural Trust.

The officers of the Association for the ensuing year are as follows:

President, H. C. White, of Georgia; vice-presidents, Alston Ellis of Colorado, W. M. Liggett of Minnesota, S. M. Emery of Montana, C. S. Plumb of Indiana, and E. W. Hilgard of California; secretary and treasurer, E. B. Voorhees of New Jersey; executive committee, H. H. Goodell of Massachusetts (chairman), A. Cope of Ohio, J. H. Washburn of Rhode Island, R. H. Jesse of Missouri, and *ex officio* the president, the junior ex-president (G. T. Fairchild), and the secretary and treasurer; bibliographer, A. C. True, of Washington, D. C.

Section on college work.—Chairman, Alston Ellis, of Colorado; vice-chairman, J. L. Snyder, of Michigan; secretary, E. A. Bryan, of Washington.

Section on agriculture and chemistry.—Chairman, R. J. Redding, of

Georgia; vice-chairman, C. D. Smith, of Michigan; secretary, T. L. Haecker, of Minnesota.

Section on horticulture and botany.—Chairman, S. T. Maynard, of Massachusetts; secretary. H. L. Russell, of Wisconsin.

Section on entomology.—Chairman, J. B. Smith, of New Jersey; secretary, C. M. Weed, of New Hampshire.

Section on mechanic arts.—Chairman, W. S. Aldrich, of West Virginia; vice-chairman, A. J. Wiechardt, of Mississippi; secretary, F. P. Anderson, of Kentucky.

The committee on nomenclature is as follows: H. P. Armsby, of Pennsylvania; C. M. Weed, of New Hampshire; E. H. Jenkins, of Connecticut, and E. S. Goff, of Wisconsin.

MEETINGS OF SECTIONS.

SECTION ON COLLEGE WORK.

The sessions of the section on college work were devoted principally to papers and discussions on "How may university extension work be best conducted by the colleges of agriculture?" and "Preparatory work in colleges."

The first paper on the first subject was presented by I. P. Roberts, of New York. The term "university extension" was considered too comprehensive, and it was suggested that probably a better and more natural course of studies in the schools may be secured by renaming the university extension work "nature study" and reconstructing the courses in the schools, so that the youth of the land may "become interested in the growth and development of animals and other natural objects by which they are surrounded and with which they will have to do in after life, whatever vocation they follow." After pointing out the inadequacy of present methods of training and educating farmers' children, the part that the agricultural colleges may play in this work was discussed, and the progress made in this line in New York under the patronage of the State and the auspices of Cornell University was explained. It was insisted that this extension work must be something more than farmers' institutes. It can only be successful when carried out through the agency of well-trained and enthusiastic teachers and carefully planned courses of study, with suitable text-books and pamphlets of information. It is along this line that the work in New York is being conducted.

A. W. Harris, of Maine, briefly discussed the same subject.

B. C. Buffum, of Wyoming, explained briefly the plan of university extension which is being inaugurated in Wyoming. This is similar to the Chautauqua method. Courses of reading are outlined and information given by correspondence. Lectures have also been given in several towns of the State. When a certain specified course of study has been finished the student is given a certificate which will allow him to omit that line of work when he comes to the State university.

J. L. Snyder, of Michigan, spoke of the institute work in Michigan, and also of the educational work which is being undertaken on the Chautauqua plan. The Superintendent of Public Instruction has been authorized by the State legislature to prepare an agricultural course for the district schools, and the preparation of bulletins for use in connection with these courses has been undertaken.

J. H. Canfield, of Ohio, referred to the women's clubs as likely to exert an increasingly important educational influence. He pointed out the danger of attempting too much and thus "dissipating our energies and neglecting the specific work given us to do."

The first speaker on the second topic, "Preparatory work in colleges," was R. H. Jesse, of Missouri. He questioned both the legality and propriety of preparatory courses in the agricultural colleges. These should be colleges in fact as well as in name, and the preparatory studies should be provided for in the lower schools. He thought that courses of agriculture, horticulture, and mechanic arts should be introduced in the district schools. He referred to the report of the committee of 12 of the National Educational Association on rural schools, which has "declared in favor of the building up of a course of study for the rural schools around the farm as a center of interest." To aid this movement the University of Missouri has undertaken a series of summer courses for the instruction of teachers in manual training, drawing, horticulture, and entomology.

In a paper on the same subject by E. W. Hilgard, of California, the belief was expressed that the drift of development of the colleges in the older States was toward the view that these colleges were not designed to educate the mass of farmers' sons, but chiefly to train agricultural experts and leaders of progress, and that the courses should be planned accordingly.

A. Ellis, of Colorado, thought it impossible to devise a plan universally applicable. He saw no legal obstacle to the introduction of preparatory courses in the colleges, and thought such courses under present conditions in many States were an absolute necessity. Public schools as at present conducted do not properly prepare students for the agricultural colleges. As soon as they do accomplish this, preparatory courses in the colleges may very properly be dispensed with.

J. H. Connell, of Texas, stated that in his experience the public schools educated away from the industrial lines. He thought that the desired results could be obtained only by instruction of teachers in industrial lines by means of summer normal schools at the agricultural colleges.

W. M. Hays, of Minnesota, presented a paper on this subject, in which he discussed the industrial training in secondary schools in North Dakota, Iowa, and Minnesota, laying especial emphasis on the fact that "every agricultural college has some things peculiarly its own to consider in bridging over the gap between the common school and the college course." The plan of secondary agricultural schools which is being successfully followed in Minnesota was discussed at some length.

SECTION ON AGRICULTURE AND CHEMISTRY.

The proceedings of the section on agriculture and chemistry opened with the reading of a paper by I. P. Roberts entitled, "Science *vs.* Art." The author professed his inability to draw any line of distinction between science and art, and argued that instead of studying science for science's sake, "so-called science and art are or should be studied for the benefit, comfort, and intellectual and moral welfare of mankind." He insisted that the attention of the experimenters and teachers in agricultural colleges and experiment stations should be devoted primarily to those problems which have direct economic bearing upon the welfare of the people.

This paper provoked quite general discussion. H. W. Wiley insisted that rigid scientific investigation was the basis of all progress, and that every truth, every discovery had in it the germ of usefulness to mankind. J. E. Stubbs expressed the belief that it was possible to so coördinate the work of the stations as to meet both the scientific and economic requirements of the subject.

The voluntary committee on uniformity of fertilizer laws in the United States and needed reforms in the inspection of fertilizers submitted a report, which was accepted by the section, and a committee was appointed to take charge of this matter and report at the next convention of the Association (see p. 313).

C. A. Zavitz, of the Ontario Agricultural College, described at length the plan, scope, and growth of the coöperative experimental work of that institution, especially in the line of variety tests. The college is assisted in this work by the members of what is known as the Experimental Union, which is composed of ex-students of the Agricultural College and farmers who are coöperating with the college in the experimental work. At present the college is conducting 17 different kinds of coöperative experiments, covering variety and fertilizer tests with corn, wheat, barley, oats, and turnips. An average of 79 per cent of the experimenters report results of their work, and 35 per cent of the total number furnish reports that are sufficiently accurate and detailed to be used. Some prominent results of these experiments have been the introduction and wide dissemination of a Siberian variety of oats, a French variety of wheat, a Russian variety of barley, and new and profitable varieties of peas from New Zealand and from England. These improved varieties are now quite generally grown throughout Canada. Another valuable feature of these experiments is the fact that good object lessons are constantly before the farmers in over 2,800 localities.

C. D. Smith, of Michigan, discussed some special experimental problems in the Northwest. The leading problems enumerated were, (1) the maintenance of soil fertility, (2) the prevention of the spread of noxious weeds, (3) the improvement and adaptation to the climatic conditions of the Northwest of varieties of grains and grasses and forest trees, and (4) the prevention of the spread of tuberculosis in cattle.

W. J. Spillman, of Washington, called attention to the importance, in the far Northwest, of studying the grasses and forage plants adapted to the local soil and climatic conditions, in order that the live stock industry of that region may be properly developed.

The value of chemical analysis of soils was discussed by H. Snyder, W. L. Hutchinson, and others.

A report on uniformity of nomenclature relating to fertilizer and feeding-stuff terms was submitted by H. P. Armsby, chairman of the committee on this subject. After some discussion, this matter was referred to the Association in general session (see p. 307).

SECTION ON HORTICULTURE AND BOTANY.

In the section on horticulture and botany the first paper was presented by S. A. Beach, of New York, on "Methods of keeping records of horticultural work." This paper explained the system of note taking followed in the very extended tests of varieties of fruits at New York State Station. The method provides for a correct record of methods of propagation and the source of each plant, continuity of record, and a card-note system which epitomizes the notes of the daybook and journal and supplements these by drawings, photographs, trade-catalogue and newspaper cuts, comments, and descriptions. Specimen pages of the notebooks and samples of the cards were shown.

A paper on the "Importance of mycophagy in the course of botanical instruction" was read by H. N. Starnes, of Georgia, and elicited much discussion in regard to the best methods of teaching the student and reader to distinguish between edible and poisonous fungi. Attention was called to the great food value of these plants and the importance of a knowledge of them from an economic standpoint. The consensus of opinion seemed to be that the use of only such common forms as can be easily determined should be advised.

L. C. Corbett, of West Virginia, presented a report from the committee on plant registration which showed the progress which had been made by the committee in interesting botanists and horticulturists in this subject, and included the specific recommendation of a subcommittee, noted on page 314.

R. H. Price, of Texas, submitted a paper on "Classification of varieties of peaches," in which attention was called to the variation in peaches with climatic conditions and the difficulty of devising a definite system of classification. The Onderdonk system is considered the most satisfactory. The author divides peaches now cultivated in the United States into 5 races: (1) Peen-To, (2) South China, (3) Spanish or Indian, (4) North China, and (5) Persian, and discusses the seed characteristics and variations due to climate of these different races. He recommended that a committee of 3 be appointed to undertake coöperative tests of different races of peaches under different climatic conditions. The committee appointed in conformity with this recommendation was R. H. Price, of Texas; E. J. Wickson, of California; G. H. Powell, of Delaware, and L. R. Taft, of Michigan.

S. B. Green, of Minnesota, read a paper entitled "Horticultural education in Minnesota," in which, by giving a list of the fruits of merit in Minnesota, he brought out the fact that the horticultural experience of the East or of the Pacific Coast may be of little use in the North-central United States. It has been found necessary to prepare text-books especially adapted to these peculiar conditions, and this has greatly aided in the solution of the problem of horticultural education in this region.

The subject of seed testing was reported upon by the committee on that subject and rules governing this work as formulated by the committee were adopted by the section (see p. 314).

Two other papers were submitted to this section, namely, "An experiment, its conception and methods of procedure," by H. L. Bolley, of North Dakota (see p. 313), and "A bacterial disease of cabbage and cauliflower," by H. L. Russell, of Wisconsin. The latter discussed the history, symptoms in the field, and cause of a disease of cabbage and cauliflower which has been studied by the author for several years. The investigations indicate that the disease is due to a yellow pigment-forming bacillus which has been separated in pure cultures and used in the production of the disease on different plants by means of inoculation. The paper also discussed the relative susceptibility of different host plants, modes of entering the plants, sources of infection, influence of climatic conditions, and remedial measures.

SECTION ON ENTOMOLOGY.

At the session of the section on entomology only two persons were present, and these simply went through the form of holding the meeting and nominating officers. The following papers were read by title: "Teaching entomology," by E. E. Bogue, of Oklahoma; "The western pine butterfly," by J. M. Aldrich, of Idaho; and "*Aspidiotus perniciosus* in North Carolina," by G. McCarthy, of North Carolina.

SECTION ON MECHANIC ARTS.

In the section on mechanic arts a paper on "Electrical engineering in Utah" was read by J. Jensen, of Utah. In this paper the author discussed the extent of the available water power in Utah above the irrigable region and the use that is being made of this power by different companies in the generation of electricity. "It appears that a million horsepower as an estimate for the total available hydraulic power of the State is a very conservative figure." Through the accomplishment of long-distance transmission of power electrically this energy has become available, since "by locating the power plant above the head of the irrigation system the water can be made to turn the electric generator and then continue along its course undiminished and do service for the farmer as before, while the energy obtained from it may be transmitted to the valley, or even to the more remote centers of industry, and there serve its purposes." The general features of a plant for this purpose were described and detailed accounts given of several plants which are already in operation in the State.

A committee of 3 to determine and propose means that will promote greater interest in the section on mechanic arts was appointed, as follows: A. J. Wiechardt, C. R. Richards, and W. S. Aldrich.

C. R. Richards, of Nebraska, submitted a paper on the "Calorimetric determination of the heating value of corn." This paper gave results of comparative tests of the fuel value of corn and coal when burned under boilers and in a fuel calorimeter. From the results thus obtained a table was constructed showing what must be the relative price of corn and coal in order that the former may be economically used for fuel.[1]

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[1] A preliminary report on these investigations is given in E. S. R., 9, p. 196.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The determination of phosphoric acid as phospho-molybdic anhydrid, WOY (*Chem. Ztg., 21 (1897), No. 44, pp. 441–443*).—Continuing the work of Meineke and Hundeshagen, the author has succeeded in perfecting a method by which phosphoric acid may be determined by means of molybdic solution without subsequent precipitation with magnesia mixture. The reagents necessary are a 3 per cent solution of ammonium molybdate (120 gm. of molybdate in 4 liters of water), ammonium nitrate solution (340 gm. in 1 liter of water), nitric acid of 1.153 specific gravity (25 per cent HNO_3), and a wash solution containing 200 gm. of ammonium nitrate and 160 cc. of nitric acid in 4 liters of water. The method of procedure is as follows: To an aliquot of the solution corresponding to 0.5 gm. of the substance add 30 cc. ammonium nitrate solution and 10 or 20 cc. of nitric acid, and heat over a lamp until bubbles commence to rise. Run into the middle of the hot solution the necessary quantity of the molybdic solution, also heated to the same temperature, keeping the solution in motion with a circular movement of the beaker. The precipitate forms rapidly, and in from 10 to 15 minutes has subsided sufficiently to filter. Filter through a porcelain Gooch crucible with suction. Wash the precipitate by decantation with 50 cc. of the hot wash solution and then redissolve into the same beaker with 10 cc. of an 8 per cent ammonia solution. Add 20 cc. of ammonium nitrate, 30 cc. of water, and 1 cc. of molybdate solution. Heat over a lamp as before, and reprecipitate by adding 20 cc. of hot nitric acid, drop by drop, the solution being kept in motion as before. Allow the precipitate to subside, filter the solution through the same crucible, and wash with the wash solution. Place the Gooch crucible inside a nickel crucible and heat gradually until the bottom is of a dull red color. After about 15 minutes of this treatment the yellow precipitate is completely converted into the black anhydrid, 24 MoO_3 P_2O_5, containing 3.946 per cent P_2O_5.—J. T. ANDERSON.

On the determination of lime, alumina, and iron in mineral phosphates, L. LINDET (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 4, pp. 246, 247*).—The only new analytical feature proposed is the method suggested for destroying the citric acid in a solution from which phosphoric acid has been precipitated. This is accomplished according to

Villiers' method by saturating the solution with nitric acid, adding 0.5 gm. of manganese sulphate or nitrate and heating gently, adding more nitric acid from time to time as the evolution of gas ceases. Vanadyl dichlorid ($VaO\ Cl_2$) is suggested as a substitute for the manganese salts.

A reaction for nitrous acid, E. RIEGLER (*Pharm. Centralhalle, 38 (1897), p. 191; abs. in Chem. Ztg., 21 (1897), No. 35, Repert., p. 99*).—To 15 cc. of the solution to be tested add 0.02 to 0.03 cc. of a mixture of equal parts of naphtionic acid and pure β-naphthol and 2 or 3 drops of concentrated hydrochloric acid, and shake vigorously for a minute. Hold the test tube in a slanting position and pour in 1 cc. of ammonium hydrate. If nitrous acid is present a red ring is formed, and this coloration is imparted to the whole solution when it is shaken. One part of nitrous acid in 1,000,000 of water is sufficient to give the reaction.

The phloroglucin method for the estimation of pentosans, J. B. LINDSEY and E. B. HOLLAND (*Massachusetts Hatch Sta. Rpt. 1896, pp. 97–99*).—The phloroglucin method for the estimation of pentosans, suggested by Councler[1] and modified by Kruger and Tollens,[2] of which a description is given, was compared with the method employing phenylhydrazin. Determinations were made by both methods with English hay, high-grown salt hay, branch grass, low meadow fox grass, Buffalo gluten feed, and lupine seed. "With two exceptions, the two methods show very closely agreeing results. We propose to still further compare these methods in the near future. The phloroglucin method, on account of its greater simplicity, is much to be preferred."

New distinguishing characteristics of butter and margarin, J. HOFFMAN (*Chem. Ztg., 21 (1897), No. 57, pp. 571, 572, fig. 1*).—The two fats are dissolved in ether, and drops of the clear solutions are allowed to fall upon glass plates. The residue of margarin left after the evaporation of the ether is in the form of a disk with a sharply serrated edge, while that from butter shows a wavy edge without being distinctly serrated. The distinction is sharper when alcohol is added to the ether solutions.

A method of determining butter and margarin and mixtures of the two in an exact way is proposed, which depends on the difference in the degree of solubility of these substances in absolute alcohol. Butter dissolves more readily than margarin, and mixtures of the two give corresponding intermediate results.—J. T. ANDERSON.

Some remarks relative to the carbohydrates of agricultural plants and seeds, J. B. LINDSEY (*Massachusetts Hatch Sta. Rpt. 1896, pp. 90, 91.*)—This article contains brief statements concerning the present knowledge of the composition of crude fiber and extract matter.

Researches on phosphoric acid: Determination of pyrophosphoric acid, BERTHELOT and ANDRÉ (*Ann. Chim. et Phys., 7. ser., 10 (1897), June, pp. 184–189*).—See also Compt. Rend. Acad. Sci. Paris, 123 (1896), p. 773 (E. S. R., 9, p. 23).

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[1] Chem. Ztg., 18 (1894), p. 966 (E. S. R., 6, p. 189).

[2] Ztschr. angew. Chem., 1896, p. 33 (E. S. R., 7, p. 830).

On the reactions in the cold between phosphoric acid and ether in the presence of water, BERTHELOT and ANDRÉ (*Ann. Chim. et Phys., 7. ser., 10 (1897), June, pp. 210–217*).—The results indicate that the difference in solubility of phosphoric acid in ether and in water may be generally utilized in the analytical study of this substance.

Facts relating to the history of metaphosphoric acid, BERTHELOT and ANDRÉ (*Ann. Chim. et Phys., 7. ser., 10 (1897), June, pp. 204–210*).—See also Compt. Rend. Acad. Sci. Paris, 124 (1897), p. 265 (E. S. R., 9, p. 23).

On the simple and complex pyrophosphates of magnesium, BERTHELOT and ANDRÉ (*Ann. Chim. et Phys., 7. ser., 10 (1897), June, pp. 190–197*).—A brief report of the results of a study of the composition of the precipitate obtained from a solution of pure sodium pyrophosphate by the addition of pure magnesium chlorid in the presence of amonia, being a continuation of the investigations noted above.

Transformation of pyrophosphoric acid, BERTHELOT and ANDRÉ (*Ann. Chim. et Phys., 7. ser., 10 (1897), June, pp. 197–204*).—See also Compt. Rend. Acad. Sci. Paris, 123 (1896), p. 776 (E. S. R., 9, p. 23).

The determination of meta and pyrophosphoric acid in dried superphosphates, PIROU and VON MÉZENCE (*Ann. Chim. Analyt. et Appl., 2 (1897), p. 4*).

The quantitative separation of wheat proteids, G. L. TELLER (*Arkansas Sta. Rpt. 1896, pp. 81–104*).—A reprint from Bulletin 42 of the station (E. S. R., 8, p. 854).

Spectroscopic determinations of metals in the artesian water of Castel-Franco and of cesium in the ashes of cultivated plants, A. CASALI (*Staz. Sper. Agr. Ital., 30 (1897), No. 3, pp. 211–219*).—Cesium, rubidium, and lithium were detected in the artesian water. Of the ashes of 20 plants examined all except 2 gave a reaction for cesium.

Chemical constitution of the vegetable alkaloids, A. PICTET (*Constitution chimique des alcaloides végétaux. 2d ed. Paris: Masson & Co., pp. 421*).

A pipette for the rapid and exact measurement of liquids, M. KNUDSEN (*Chem. Ztg., 21 (1897), No. 64, p. 637, fig. 1*).—A glass pipette of ordinary form is provided at the mark with a stopcock which has both transverse and longitudinal openings. With this cock in proper position the pipette is filled by suction to some point above the cock. A turn of the cock closes the pipette and secures the liquid. A further turn of the cock admits air through the longitudinal opening to the space below the cock, and the liquid in that space is discharged, that above the cock remaining undisturbed.—J. T. ANDERSON.

A new laboratory apparatus, H. WITZEL (*Chem. Ztg., 21 (1897), No. 53, p. 536, fig. 1*).—A modified Kipp's gas generator is provided with a flask for washing or drying the gas before it is emitted. A device for preventing the spurting out of the wash liquid is attached.—J. T. ANDERSON.

A new method for preparing chemically-pure hydrogen sulphid, J. R. MICHLER (*Chem. Ztg., 21 (1897), No. 67, p. 659, fig. 1*).—The materials used are hydrochloric acid and calcium sulphohydrate. The apparatus is a modified Kipp's apparatus with a fountain for the acid and a wash flask to purify the gas.—J.T. ANDERSON.

Agricultural chemical work, 1896, V. STEIN (*Tidsskr. Landökon., 15 (1896), pp. 717–737*).—A brief report of analytical work performed for the Royal Danish Agricultural Society during 1896. In all, 6,915 samples were analyzed or examined, viz, fodders, 425 samples; fertilizers, 1,634 samples; dairy products, 4,795 samples (milk, 2,434; butter, 2,301; and cheese, 60); miscellaneous analyses, 61.

Treatise on the analysis of agricultural substances, L. GRANDEAU (*Traité d'analyse des matières agricoles. Paris: Berger-Levrault & Cie., 1897, Vol. I, pp. 560, figs. 54; Vol. II, pp. 614, figs. 117*).—This is the third edition (revised and enlarged) of this well-known work. The first volume deals with methods of analysis in general, analysis of soils and fertilizers, and fertilizer legislation; the second with air, water, analysis of plants, fodders, animal products, manure, wool, milk, fats, and fermented liquors.

For a review of this edition by P. P. Dehérain see Ann. Agron., 23 (1897), No. 5, p. 229.

BOTANY.

Report of the botanist, G. E. STONE and R. E. SMITH (*Massachusetts Hatch Sta. Rpt. 1896, pp. 57–84, figs. 6*).—The nature of plant diseases in general is briefly stated and numerous diseases are more or less fully described.

A bacterial disease of the strawberry, which is considered to be due to the action of *Micrococcus* sp., is characterized by the dark-colored shriveled leaves. The bacterium was isolated, and from its manner of growth in gelatin it proved to be anaërobic. Inoculation experiments were successfully made, and the author considers the disease probably of little consequence, the plants being attacked only when the proper conditions are at hand, such as favorable weather and weakened condition of the plants. It is thought that entrance to the plant is gained through the roots, and any attempt at applying fungicides would be useless.

Brief notes are given on a stem rot of the cultivated aster, microscopic examinations of the diseased tissue of which showed a variety of organisms, such as bacteria, nematodes, and various mold-like fungi. The disease is to be given further investigation.

Leaf-spot diseases of various decorative plants are mentioned, and preventive treatment suggested.

A leaf-spot disease of the india rubber plant is figured and described. The first indication of the disease is the appearance of small spots or streaks on the leaves, which finally turn to an ashy-gray color. The disease is said to be caused by *Leptostromella elastica*. An effect caused by sunburn is superficially somewhat similar to this disease and is sometimes mistaken for it. No suggestions are given for its prevention.

Leaf-spot diseases of the date and other palms and of begonias are figured and described.

A so called black spot of the rose, due to *Pilobolus crystallinus*, is described. The fungus is probably saprophytic, and with proper precautions could be prevented from attacking plants.

The anthracnose of cucumber (*Colletotrichum lagenarium*) is briefly described, and judicious spraying with Bordeaux mixture or other fungicides, together with the proper management of the crop, is recommended for its prevention.

A rust of asparagus, due to *Puccinia asparagi*, is figured and described, and as it only appears on the plants late in the season and is of intermittent occurrence, there is no immediate danger to be apprehended from it. However, its continued attack upon the plants will weaken them, finally causing their total destruction, and on this account the tops should be collected and burned in the fall.

A late rust of the blackberry, due to *Chrysomyxa albida*, is described, and the same precautions are recommended for its prevention as have been given for the asparagus rust. This disease has been called the fall rust to distinguish it from the earlier form which attacks both blackberries and raspberries, the late rust attacking only the blackberry.

The tomato mildew (*Cladosporium fulvum*), a common disease in greenhouses, is described, and the application of any of the ordinary fungicides is recommended as a preventive treatment, together with the precaution of burning all dead leaves and vines when the crop is removed.

A chrysanthemum rust is described, in which the form examined closely resembled and probably is identical with *Puccinia tanaceti*, which occurs on many of the composite plants. It is thought advisable to spray the plants occasionally with Bordeaux mixture or potassium sulphid solution, commencing early in the summer before the disease appears. If plants are healthy when put into the house one or two sprayings thereafter should carry them through the winter.

"Drop" of lettuce, which is due to a species of Botrytis, is briefly described, and numerous methods for controlling it are suggested. What is considered the cheapest and probably the best method of treatment, not only for this fungus but for other pests of the soil, is to heat the earth with steam up to 130 to 200° F. While the author has not tried this method, he supposes that if the soil was heated to 200° F. it would result in the destruction of the fungus.

Two physiological disorders of plants are mentioned—a wilt of maple leaves and top burn of lettuce. Both these diseases are intimately connected with the transpiration and lighting of the plants.

Experiments on the assimilation of ammoniacal and nitric nitrogen by the higher plants, E. LAURENT, E. MARCHAL, and E. CARPIAUX (*Bul. Acad. Roy. Sci. Belgique, 1896, Dec. 12; abs. in L'Engrais, 12 (1897), No. 19, pp. 447, 448; Ann. Agron., 23 (1897), No. 5, pp. 235–237*).—The authors have carried out an elaborate series of experiments, the principal results of which may be summarized as follows:

The reduction of nitrates in green leaves is a phenomenon due principally to the action of the more refrangible rays of the spectrum.

In darkness the etiolated stems of the potato assimilate neither ammoniacal nor nitric nitrogen. The green stems assimilate both ammoniacal and nitric nitrogen in sunlight.

The stems of asparagus, which contain little chlorophyll, assimilate both nitric and ammoniacal nitrogen (the latter more rapidly than the former) in sunlight.

The blanched leaves of the elm assimilate nitric nitrogen with difficulty, perhaps not at all, and they appear to reduce nitrates with difficulty. They, however, rapidly assimilate ammoniacal nitrogen. In sunlight the green leaves rapidly assimilate both nitric and ammoniacal nitrogen, the latter more rapidly than the former.

In sunlight the etiolated leaves of the ash-leaved maple assimilate ammoniacal nitrogen much more rapidly than nitric nitrogen. Under the same conditions the green leaves assimilate nitrates energetically, but ammoniacal nitrogen much less freely. In darkness the blanched leaves do not assimilate ammoniacal nitrogen and the green leaves do not utilize nitrates for the elaboration of nitrogenous organic substances.

In the light the green and blanched leaves of Aspidistra assimilate nitric and ammoniacal nitrogen, the first preferring the nitrates, the second ammonia.

There is no assimilation of nitric nitrogen by the green leaves of box elder under solutions of bichromate of potash and sulphate of quinin. Assimilation, however, is very active under solutions of sulphate of copper and under water, indicating, therefore, that the ultra-violet rays are the ones principally involved in this assimilation. The blanched leaves of this plant do not assimilate ammoniacal nitrogen except to a very slight extent under any conditions, and not at all under solutions of bichromate of potash and sulphate of quinin. Under water, however, there is considerable assimilation, indicating that the assimilation of ammoniacal nitrogen is also stimulated by the ultra violet rays.

The general conclusions reached are that the assimilation of nitrates will not take place in the higher plants when all the rays of the spectrum are cut off. The ultra violet rays are necessary to assimilation. These rays are predominant in the assimilation of ammoniacal salts, although the luminous rays may produce assimilation of ammonia to a slight extent in blanched leaves. The intervention of chlorophyll is not necessary. Blanched leaves assimilate ammoniacal nitrogen much more readily than green leaves.

The dependence of the respiration of plants on their content of insoluble protein, V. I. PALLADIN (*Trudi Obsh. Ispit. Prirodi Imp. Kharkov. Univ., 29* (*1896*)).—The author made a number of experiments with wheat, beans, and lupines. The principal conclusions reached were the following: The amount of insoluble protein gradually increases during the germination of wheat in the dark, while during the germination of lupines in the dark a part of the insoluble protein becomes soluble and further germination is accompanied by the formation of a small quantity of new insoluble protein. The respiration energy of seeds germinating in the dark gradually increases, not as a consequence of more rapid growth, but on account of the increase of insoluble protein substance contained in them. When there is a sufficient amount of carbohydrates present the quantity of carbon dioxid exhaled by plants is directly proportional to the quantity of insoluble protein contained in them. The ratio of carbon dioxid exhaled to the nitrogen of insoluble proteids in the author's experiments was constant, the temperature remaining the same.—P. FIREMAN.

Report of botanical department, J. C. ARTHUR (*Indiana Sta. Rpt. 1896, pp. 28–37, pl. 1, figs. 2*).—The author briefly reports upon the various lines of work carried on during the year. The value of formic aldehyde, or formalin, as a germicide for the prevention of potato scab is reported upon, and the preliminary trials were of a very promising character. All the tests gave results that warrant the belief that formalin is a satisfactory preventive means for potato scab. A full report on these experiments is to be published as a bulletin.

The effect of various forms of phosphates on the growth of roses was determined and will be reported upon in bulletin form.

The author's studies on corn smut were continued from the previous year, and the results are being arranged for publication.

Brief mention is made of a carnation disease which has already been reported upon in Bulletin No. 59 of the station (E. S. R., 8, p. 235).

Experiments were conducted during the winter of 1895–'96 in forcing lettuce, in which the best ways of feeding, watering, and handling the plant were studied. The work is being repeated with certain modifications and will be a subject for future publication.

Considerable time has been devoted to gathering data relative to the occurrence and spread of weeds throughout the State.

Description of the equipment of the station, of the greenhouses, etc., are given.

Inoculation experiments with Nitragin, D. DICKSON and L. MALPEAUX (*Jour. Agr. Prat., 61 (1897)), II, No. 31, pp. 191–197, figs. 2*).—The description of the work is preceded by a brief description of Nitragin and allusions to other investigators and their work.

Inoculation experiments were made with white lupine and crimson clover grown in sterile sand and white lupine and hairy vetch grown in forest soil. The experiments were made in pots and were partly duplicated in the open field, but on different soil. The Nitragin in some cases was applied to the seed and in others to the soil.

The inoculations were more effective in the sandy soil than in soils richer in nitrogen. The authors believe that long-cultivated, fertile soils contain the nitrogen-fixing bacteria in sufficient numbers for the growth of legumes without special inoculation. It is stated that good effects from inoculation may be expected of newly broken acid soils which contain insufficient nitrogen-appropriating bacteria and of soils in which inoculation has already rendered some service. Inoculation of the soil gave better results than inoculation of the seed.

American grasses, F. LAMSON-SCRIBNER (*U. S. Dept. Agr., Division of Agrostology Bul. 7, pp. 331, figs. 302*).—An illustrated bulletin describing 302 species of North American grasses. The prominent characteristics, habitat, distribution, and time of flowering of each species are given. The order of Gramineæ and the tribes into which the order is divided are briefly characterized.

General report of the botanical survey of the Coeur d'Alene Mountains in Idaho during the summer of 1895, J. B. LEIBERG (*Contributions from the United States National Herbarium, vol. 5, 1897, No. 1, pp. 85, map 1*).—The author gives his itinerary, describes the topography, drainage, and climate of the country, and discusses its agricultural and forest resources, and the utilization of its water supply. Under forest resources, the author describes the condition of 14 species of evergreens and mentions the deciduous trees occuring in that region. The location and extent of burned areas and the reason for the preservation of the forests are given and a system for timber protection is outlined.

A descriptive catalogue of useful fiber plants of the world, C. R. DODGE (*U. S. Dept. Agr., Fiber Investigations Rpt. No. 9, pp. 361, pls. 13, figs. 103*).—This publication is an enumeration of 1,018 species of useful fiber plants, the more important of which are fully described from a botanical, agricultural, and industrial standpoint. The scientific, commercial, and common names of the plants and also the native names, when they could be obtained and verified, are given, and the kind of fiber produced, the part of the plant producing it, and the botanical relationship of the species are indicated. In addition to the catalogue proper, the work treats of the definition of fibers, their ancient uses, their commercial uses in the United States, their imports, and their study from an economical, chemical, and micro-chemical standpoint. Two classifications, one based on the structure of the fibers and the other on their uses, are outlined. An article on the identification of fibers, a description and history of laces, and brief statements regarding fiber machinery and its uses are appended.

Little-known grasses, F. LAMSON-SCRIBNER (*U. S. Dept. Agr., Division of Agrostology Bul. 8, pp. 5–11, pls. 7, fig. 1*).—The author gives descriptive notes and illustrations of the following species: *Poa turneri, P. leibergii, Panicum leibergii, Elymus brownii, E. flavescens, E. dasystachys littoralis, Eragrostis obtusiflora, Sporobolus plumbeus*, and *Muhlenbergia flaviseta*.

The water hyacinth and its relation to navigation in Florida, H. J. WEBBER (*U. S. Dept. Agr., Division of Botany Bul. 18, pp. 7–20, pl. 1, figs. 4*).—The bulletin discusses the structure, growth, and propagation of the water hyacinth; its introduction, dissemination, and present distribution in Florida; the damage it causes to bridges, navigation, the timber and fishing industries; the possibilities of its extermination, and the methods of keeping it in check. It has become a serious pest only in sluggish fresh-water streams. The author believes that the entire eradication of it is not feasible. Among other means of keeping it in check the agency of diseases is suggested.

Contribution to the knowledge of the Rubi corylifolii, K. FRIDERICHSEN (*Bot. Centbl., 70 (1897), No. 11–12, pp. 340–350*).—Notes are given on the affinities, etc., of the species of Rubus in the Corylifolii group.

General description of the Cactaceæ, K. SCHUMANN (*Reviewed in Naturw. Rundschau, 12 (1897), No. 32, p. 410*).

On the rôle of histology in the classification of fungus spores, P. A. DANGEARD (*Botaniste, 5. ser., 1897, No. 6, pp. 314–317*).

Concerning the history of the question of sexuality in plants, F. KAMIENSKI (*Le Monde des Plantes, 19 (1897), No. 91, pp. 121–125*).

On the sexual production of the Ascomycetes, P. A. DANGEARD (*Botaniste, 5. ser., 1897, No. 6, pp. 245–284, figs. 17*).—A second memoir.

Investigations on the origin and development of the sex organs of Triticum with special reference to nuclear division, M. KÖRNICKE (*Verhandl. natur. hist. Ver. Preuss. Rheinlande, 53 (1896), pp. 149–185, pl. figs. 3*).

Recent investigation on cross-fertilization and self-sterility, W. O. FOCKE (*Abhandl. Naturw. Ver. Bremen, 14 (1897), No. 2, pp. 297–304; abs. in Bot. Centbl., 71 (1897), No. 7, p. 235*).

Development of the pollen grains of Allium fistulosum, C. ISHIKAWA (*Jour. Col. Sci. Imp. Univ. Tokyo, vol. 10, Pt. II, pp. 31, figs. 2; abs. in Bot. Centbl., 71 (1897), No. 6, pp. 211, 212*).—This is a contribution to the study of chromosome reduction.

The leaf structure of Jouvea and Eragrostis obtusiflora, Miss E. L. OGDEN (*U. S. Dept. Agr., Division of Agrostology Bul. 8, pp. 12–20, pls. 2*).—Anatomical studies are given of the leaf structure of *Jouvea pilosa* and *J. straminea* and comparisons made with the structure of the leaves of *Eragrostis obtusiflora* and *Distichlis spicata*.

Concerning the value of leaf anatomy for the characterization of Juniperus communis, J. nana, and J. intermedia, J. ERB (*Ber. schweiz. bot. Gesell., 7 (1897), pp. 83–95*).

Concerning the structure of the membrane in vascular tissues, W. ROTHERT (*Anzeig. Akad. Wissensch. Krakau, 1897, Jan., pp. 18; abs. in Bot. Centbl., 71 (1897), No. 4, pp. 131–133*).

Comparative morphological investigations of the leaves of Ranunculaceæ and Umbelliferæ, G. BITTER (*Flora, 83 (1897), No. 2, pp. 223–301, figs. 31*).

Comparative anatomical studies of the structure of winged fruits and seeds, C. VON WAHL (*Bibliotheca Botanica, 1897, No. 40, pp. 25, pls. 5; abs. in Bot. Centbl., 70 (1897), No. 11–12, pp. 369–371*).

Investigations on the structure of the Mucorineæ, M. LÉGER (*Thesis, Poitiers, 1895, pp. 151, pls. 21; abs. in Bot. Centbl., 71 (1897), No. 1, pp. 27, 28*).

On the influence of intense light upon cell division of Saccharomyces cerevisiæ and other yeasts, W. LOHMANN (*Inaug. Diss., Rostock, 1896, pp. 72; abs. in Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 13–14, pp. 369–372*).

Concerning the influence of light on growth, K. STAMEROFF (*Flora, 83 (1897), No. 2, pp. 135–150*).

Concerning the influence of heat and light upon pigmentation, A. FISCHEL (*Sitzungsb. deut. naturw. med. Ver. Böhmen, 1896, pp. 263–267; abs. in Bot. Centbl., 71 (1897), No. 3, p. 100*).

Observations on some of the chemical substances found in the trunks of trees, F. H. STORER (*Bul. Bussey Inst., 2 (1897), IV, pp. 386–408*).

Notes on the oleaginous reserve material of the walnut, LECLERC DU SABLON (*Rev. Gén. Bot., 9 (1897), No. 105, pp. 313–317*).

On the formation of alcohol by the intramolecular respiration of some of the higher plants, E. GODLEWSKI and F. POLZENINSZ (*Anzeig. Akad. Wissensch. Krakau, 1897, pp. 267–271*).

Rôle of tannin in plants, particularly in the fruit, C. GERBER (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 20, pp. 1106–1109*).—The author thinks the principal function of tannin is to check the formation of pectic compounds in the fruit and also to prevent the fermentation of the sugars. In such fruits as that of *Diospyros kaki* the tannin disappears by complete oxidation without forming any carbohydrates.

On the localization of the alkaloids in some species of cinchona, J. P. LOTSY (*Bot. Centbl., 71 (1897), No. 11, pp. 395–400*).

Concerning starch and sugar formation in barley and malt, J. GRÜSS (*Wochenschr. Brauerei, 14 (1897), No. 26, pp. 321–323*).

Investigations of the behavior of acids in the petioles of rhubarbs during various periods of growth, R. OTTO (*Apoth. Ztg., 1897, No. 37, pp. 305, 306; abs. in Bot. Centbl., 71 (1897), No. 3, pp. 103–105*).

Concerning the suppression of calcium oxalate by the growth of plant organs, G. KRAUS (*Flora, 83 (1897), No. 1, pp. 54–73*).

On the development of the Asparagineæ, G. DUTAILLY (*Assoc. Fr. Av. Sci. Congrès Carthage, 1896, II, pp. 327–359, pls. 3*).

Contribution to the chemistry of the cacti, HEFFTER (*Apoth. Ztg., 11 (1896), No. 7; abs. in Bot. Centbl., 71 (1897), No. 9, pp. 319, 320*).

Concerning the formation of protein from the nitrates in plants, E. GODLEWSKI (*Anzeig. Akad. Wissensch. Krakau, 1897, No. 3, pp. 104–121*).

On the presence of soluble starch in the leaves of Cola, P. GUERIN (*Bul. Soc. Bot. France, 3. ser., 4 (1897), No. 2, pp. 91–95*).

Experiments with Nitragin, C. A. GOESSMANN (*Massachusetts Hatch Sta. Rpt. 1896, pp. 177–182*).—A brief review is given of investigations on the assimilation of atmospheric nitrogen by leguminous plants, and Nitragin is described, with directions for its use. The station has secured the various kinds of this material and proposes to make experiments with it.

Experimental researches on the assimilation of ammoniacal and nitric nitrogen by the higher plants, E. LAURENT, E. MARCHAL, and E. CARPIAUX (*Jour. Soc. Agr. Brabant-Hainaut, 1897, No. 9*).

How plants attract insects, F. PLATEAU (*Reviewed in Naturw. Rundschau, 12 (1897), No. 32, pp. 407, 408*).

Investigations on the freezing of plants, H. MOLISCH (*Reviewed in Naturw. Rundschau, 12 (1897), No. 35, pp. 442–444*).

Injurious effect of asphalt vapors on the Berlin gardens, P. SORAUER (*Gartenflora, 46 (1897), No. 12, pp. 317–320*).

Concerning positive and negative heliotropism, F. OLTMANNS (*Flora, 83 (1897), No. 1, pp. 1–32*).

Pfaff's observations on the nature of ivy poisoning, B. F. ROBINSON (*Amer. Nat., 31 (1897), No. 370, pp. 901–903*).—A review of Pfaff's work on Rhus poisoning is given. The poisonous principle is said to be an oil to which the name Toxicodendrol is given.

Concerning the mechanical effect of rain on plants, J. WIESNER (*Ann. Jard. Bot. Buitenzorg, 14 (1897), II, pp. 277–353*).

Cutting and mounting cereal grains and starchy tubers, J. D. HYATT (*Internat. Jour. Micros. and Nat. Sci., 3. ser., 7 (1897), No. 35, pp. 250–255, pl. 1*).

The injury to plants by asphalt vapors, II, P. SORAUER (*Ztschr. Pflanzenkrank., 7 (1897), No. 2, pp. 84–89, figs. 3*).

The parenchyma sheath in the leaves of dicotyledonous plants, B. SCHUBERT (*Bot. Centbl., 71 (1897), Nos. 10, pp. 337–347; 11, pp. 385–395*).

A study of cork formation by plants, E. MATTEUCCI (*Ricerche e Lav. Roy. Mus. Orto Bot. Firenze, 1896–'97, I, pp. 87–108*).

A new method for micro-chemical treatment and embedding of very small and soft objects, A. SCHYDLOWSKY (*Ztschr. wissensch. Mikros., vol. 13, No. 2; abs. in Bot. Centbl., 71 (1897), No. 7, p. 230*).

Influence of various external factors on the water transfer of plants, P. KOSAROFF (*Inaug. Diss., Leipzig, 1897, pp. 64*).

Some phenomena in the ripening of acid fleshy fruits, C. GERBER (*Assoc. Fr. Av. Sci. Congrès Carthage, 1896, II, pp. 412–421*).

The influence of soils on the color of the flowers of Hortensia, W. ZORP (*Natur., 46 (1897), No. 27, pp. 318, 319*).

Influence of lecithin on growth, DANILEWSKY (*Compt. Rend. Soc. Biol. Paris, 1897, May 15*).

Root tubercles of legumes, their relation to their host plants, C. NAUDIN (*Jour. Agr. Prat., 61 (1897), II, No. 27, p. 46*).

The factors of growth and their influence on plant production, R. ULRICH (*Fühling's landw. Ztg., 46 (1897), No. 16, pp. 482–489*).

On the biology of flowers, P. KNUTH (*Bot. Centbl., 70 (1897), No. 11–12, pp. 337–340, figs. 2*).

On the distribution of plants, H. HESSELMAN (*Bot. Notiser, 1897, No. 3, pp. 16; abs. in Bot. Centbl., 71 (1897), No. 6, pp. 216, 217*).—The author has made a partial study of the means of plant dissemination on the east coast of Sweden.

The origin and distribution of the phelloderm, F. KUHLA (*Bot. Centbl., 71 (1897), No. 3, pp. 81–87*).

ZOÖLOGY.

The habits, food, and economic value of the American toad, A. H. KIRKLAND (*Massachusetts Hatch. Sta. Bul. 46, pp. 30, figs. 25, pls. 2*).—This details the results of a study begun in the summer of 1895 of the stomach contents of 149 toads collected alive from various parts of Massachusetts. The fallacious ideas concerning the toad held by the ancients and by some people even during the present century are brought out. The life history and habits of toads are discussed at some length.

Relative to the longevity of the toad, the author states that there are authentic European records of a toad that lived to be 36 years old, when it was accidentally killed, and he thinks it probable that our American species may be equally long lived. Relative to their feeding habits he says:

"At night, soon after sundown, or even before on cool evenings, the toad emerges from its shelter and slowly hops about in search of food. Something of a regular beat is covered by these animals, whose sense of locality is quite strong. In the country this includes forays along roadsides, into gardens and cultivated fields, and wherever insect food is abundant and grass or other thick herbage does not prevent locomotion. In cities and suburban villages the lawns, walks, and particularly the spots beneath electric lamps, are favorite hunting grounds. At Amherst, Massachusetts, the writer once counted 8 large well-fed toads seated under an arc light and actively engaged in devouring the insects, which, deprived of wings, fell from the lamp above. Dr. Charles Burleigh, a prominent physician of Malden, Massachusetts, and a close observer in the field of natural science, informs me that a colony of some half dozen toads has for some time occupied the sheltered space under the piazza of his house, and that each summer night at about 8 o'clock they sally forth down the walk, cross the street, and take up their station under an arc lamp that is located about 3 rods from the house. Here they remain and feed upon the fallen insects until the electric current is turned off, when they return to their accustomed shelter.

"During the past 2 years the writer has made many observations on toads feeding under natural conditions at all hours of the night. From these observations and from stomach examinations it appears that the toad feeds continuously throughout the night, except when food is unusually abundant. In 24 hours the amount of food consumed is equal in bulk to about 4 times the stomach capacity. In other words, the toad's stomach is practically filled and emptied 4 times in 24 hours. This I have verified by studies on toads confined in cages."

The result of the stomach examinations are shown in per cent as follows: Unidentified material, 5; gravel, 1; vegetable detritus, 1; worms, 1; snails, 1; sow bugs, 2; myriapods, 10; spiders, 2; grasshoppers and crickets, 3; ants, 19; carabids, 8; scarabæids, 6; click beetles, 5; weevils, 5; chrysomelids, 1; carrion beetles, 1; miscellaneous beetles, 1; cutworms, 16; tent caterpillars, 9; miscellaneous larvæ, 3; total beetles, 27; total cutworms, caterpillars, etc., 28.

The insects found in the stomach of the toad are discussed at length for the purpose of bringing injurious species into prominence. Balancing the noxious against the beneficial features of the toad, 4 points are found to weigh against and 7 in favor of it. A classified list of the insects found in the stomach is given, and the subject of digestion, amount of food, means of making the toad useful, and its natural enemies are discussed. It is estimated that a single toad destroys in a year insects which, if they had lived, might have damaged crops to the extent of $19.88. The practice of collecting and colonizing toads in gardens, etc., is thought commendable, as well as the idea of providing them with artificial shelters by digging shallow holes in the ground and covering the same with boards, etc.

Among the natural enemies are noted crows, various hawks and owls, and the small boy.

A brief bibliography is given.

METEOROLOGY.

Report of the meteorologist, L. METCALF (*Massachusetts Hatch Sta. Rpt. 1896, pp. 50–52*).—A brief account is given of the work of the year in this department, noting additions to equipment and changes in methods of observation. Apparatus is being arranged "and considerable work has been done preliminary to undertaking at Amherst a series of experiments bearing upon soil temperatures and moistures in their relation to the growth and advancement of crops."

Report of the assistant meteorologist, W. D. CLAYTON (*Texas Sta. Rpt. 1896, pp. 921, 922*).—A monthly summary is given of observations during 1896 on atmospheric pressure, temperature, rainfall, and prevailing wind, together with the annual averages of temperature and rainfall for 6 years (1891–'96). The average atmospheric pressure for 1896 was 29.73 in.; average maximum temperature 87.5°, minimum 43.8°, mean 67.7°; total rainfall, 39.65 in.

The meteorology of 1895 (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 8 (1896), pp. 340–347*).—A table "gives a comparison of the winds, temperature, rainfall, and sunshine of 1895 as compared with the averages of previous years," and the weather conditions during each month are discussed in detail, with brief notes on the character of the principal crops of the year.

The meteorology of 1896 (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 9 (1897), pp. 363–371*).—A table "gives a comparison of the winds, temperature, pressure, rainfall, snow, and sunshine of 1896 as compared with the previous 40 years' averages," and the weather conditions of each month are discussed in detail, with brief notes on the character of the principal crops of the year.

Meteorological observations, L. METCALF and J. L. BARTLETT (*Massachusetts Hatch Sta. Met. Buls. 100–102, pp. 4 each*).—The usual summaries of observations at the meteorological observatory of the station during the months of April, May, and June, 1897, with general remarks on the weather and crop conditions of each month.

On three French balloon ascensions, G. HERMITES and G. BESANÇON (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 21, pp. 1180–1182*).

The effects of a hailstorm, A. FOREL (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 26, pp. 1549, 1550*).—Brief notes on phenomena observed during a hailstorm which did considerable damage, especially to glass.

The diurnal oscillatory movement of the atmosphere, M. DECHEVRENS (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 25, pp. 1479, 1480*).—A brief note on observations during several years at Zikawei, China (latitude 31°), which shows that the general air movement at that point is from west to east in the morning, north to south in the middle of the day, east to west in the evening, and south to north in the middle of the night.

The tornado of June 18, 1897, at Asnières and the storm phenomena observed on that day, J. JAUBERT (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 25, pp. 1480–1482, fig. 1*).

The tornado of June 18, 1897, L. TEISSERENC DE BORT (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 25, pp. 1483, 1484*).

Summary of results of recent studies on atmospheric electricity, J. ELSTER and H. GEITEL (*Naturw. Rundschau, 12 (1897), Nos. 28, pp. 349–352; 29, pp. 365–367; 30, pp. 377–380; 31, pp. 389–393*).

WATER—SOILS.

The value of silt as a manure, J. W. LEATHER (*Agl. Ledger, 1897, No. 5, pp. 7*).—Notes are given on investigations made in India to ascertain the manurial value of the silt which is carried on to land by irrigation water. These included experiments in which oats were grown on silted and unsilted plats and chemical studies of the fertilizing value of the silt. It was found that the amount of fertilizing matter which the water carried varied widely with the season. From one series of analyses it is estimated that under ordinary conditions in India a crop which, like rice, is grown during the monsoon or kharif period, receives in the irrigation water 154 lbs. of potash, 42 lbs. of phosphoric acid, and 31 lbs. of nitrogen per acre. Under the same conditions the wheat crop, grown during the cold or rabi season, would receive 19.6 lbs. of potash, 5.2 lbs. of phosphoric acid, and 3.8 lbs. of nitrogen; while a crop of sugar cane, occupying the land during the whole year, would receive 54.6 lbs. of potash, 15 lbs. of phosphoric acid, and 10.8 lbs of nitrogen. "The amounts of the plant foods supplied in the kharif are probably sufficient for the entire rice crop; but during the rabi they are not sufficient for the wheat, and the deficiency is probably still greater in case of the sugar cane."

Studies of Oklahoma soils, J. H. BONE (*Oklahoma Sta. Bul. 24, pp. 17*).—This bulletin is in a measure supplementary to Bulletin No. 5 of the station (E. S. R., 4, p. 710), which gives results of analyses of a large number of Oklahoma soils. It briefly reports and discusses the results of observations and experiments on the texture and specific gravity of Oklahoma soils; the influence of cultivation on weight and porosity; percolation through soils of different character and treated in different ways; and the influence of plowing, rolling, surface cultivation, and freezing on soil moisture.

The principal results obtained are summarized as follows:

"(1) The soils examined at the Oklahoma Agricultural Experiment Station prove to be loose textured, with some of the properties of finer soils. They are easily handled. The specific gravity ranges from 2.60 to 2.66. Under field conditions, without water, the weight of the first 12 in. of cultivated soil was 67.5 lbs. per cubic foot, uncultivated 82, alkali 95.1 lbs.

"(2) The water supply is very important in plant production. Our rainfall is often poorly distributed, and much water is lost by poor methods of soil culture. The water content of the soil at the experiment station during the growing season of 1896 ranged from 5 to 26 per cent.

"(3) Water percolates best into freshly plowed or cultivated soil. Compacting the soil hinders percolation. The plow is the best implement for putting the soil in condition to receive the rainfall. Subsoiled ground receives more moisture during a heavy rain than unsubsoiled ground.

"(4) Cultivation conserves much soil moisture. Soil mulches prevent evaporation. Cultivation sufficient to keep the weeds from growing is very essential, but we should cultivate to conserve moisture. Very frequent cultivation is not so effective as less frequent.

"(5) Rolled ground, when dry, showed an increase in soil moisture for the first few days. It also showed a larger decrease in the second foot during 32 days.

"(6) Other things equal, the rapidity of the growth of plants depends upon the moisture content of the soil. . . . Alkali soils do not contain as much moisture as ordinary prairie."

On the fixation and nitrification of nitrogen in arable soils, P. P. DEHÉRAIN (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 5, pp. 278–283*).—Determinations of nitric and organic nitrogen were made at frequent intervals from December, 1895, to March, 1897, in a cubic meter lot of soil which was spread out in a stable and kept in the state of moisture most favorable to nitrification —20 to 25 per cent. During that period the nitric nitrogen increased from 0.14 to 1.66 gm. per kg., and the organic nitrogen declined from 3.13 to 2.57 gm., the increase in total nitrogen being from 3.27 to 4.23 gm. In case of another soil treated in the same way the nitric nitrogen increased from 0.23 to 2.32 gm.

These results show that the decrease in organic nitrogen was not sufficient to account for the increase in nitric nitrogen, and indicate that a considerable amount of the free nitrogen of the air was fixed by the soil during this period. That the increase of total nitrogen in the soil was not due to the absorption of ammonia fumes was demonstrated by a check experiment carried out in the basement of the station building, which was kept free from ammonia fumes. Here also there was a considerable increase in nitrogen.

An insufficient supply of moisture checked the fixation and nitrification of nitrogen almost completely. This occurred in one of the soils when the moisture content had only been reduced to 16.5 per cent.

Denitrification, G. AMPOLA and E. GARINO (*Centbl. Bakt. u. Par., 2. Abt., 1897, p. 309; abs. in Chem. Ztg., 21 (1897), No. 71, Repert., p. 190*).—The loss of nitrogen from barnyard manure is claimed to be due to the action of denitrifying organisms. Acids prevent this action. The addition of ground peat showing an acidity of 9.85 per cent checked the activity of the denitrifying organisms as well as that of the other ferments. The organisms, however, were not killed and commenced their activity again as soon as the acidity was neutralized. The soil conditions are favorable to the neutralization of the acid of the peat, and thus the restraining effect of the latter on the denitrifying organism is nullified in the soil.

On the rôle which humus substances play in the fertility of the soil, A. GAUTIER (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 22, pp. 1205–1206*).—The author claims that free nitrogen is fixed in appreciable amounts by algæ and microörganisms in the soil only in the presence of humus compounds, and that the nitrogen so fixed is directly assimilable by the higher plants. If the soil is deficient in humus the various organisms which fix nitrogen do not develop to a sufficient extent to enrich the soil in nitrogen.

On the determination of the potash in soils soluble in citric acid, O. VON GAROLA (*Rev. Chim. Analyt. et Appl., 5 (1897), p. 101; abs.*

in Chem. Ztg., 21 (1897), No. 35, Repert., p. 99).—In the method proposed 50 gm. of soil, which has been mixed with a sufficient amount of solid citric acid to saturate the calcium carbonate present, is placed in 250 cc. of a 2 per cent citric acid solution, and shaken for 8 hours in a shaking machine making 24 to 30 revolutions per minute. Allow the solution to stand 24 hours, and filter through a dry filter. To 200 cc. of the filtrate, corresponding to 40 gm. of the soil, add a slight excess of precipitated calcium carbonate and heat for a short time at the boiling point to precipitate the calcium citrate; filter through glass wool, or asbestus, and wash with boiling water. Evaporate the filtrate to dryness, drive off the ammonia salts, take up in water, and precipitate the potassium with platinum chlorid.

In experiments in which the digestion was continued for a longer period the results were practically the same as by the above method.

Drinking water, F. W. TRAPHAGEN (*Montana Sta. Bul. 13, pp. 15*).—This is a general discussion of the principal constituents of drinking water, the character of water from different kinds of wells, and the purification of water, accompanied by analyses showing free and albuminoid ammonia, nitrogen as nitrites and nitrates, chlorin, and total solids in 23 samples of water collected in the vicinity of Bozeman.

Water and public health, J. H. FUERTES (*New York: John Wiley & Sons, 1897, pp. 75, figs. 70*).—This contains chapters on etiology and prophylaxis of typhoid fever, when does pure water pay? and sanitary value of impounded and other supplies, and is of interest especially to physicians and sanitary engineers.

Chlorin in rain water (*Agl. Students' Gaz., 8 (1897), No. 4, p. 113*).

The bacteria of the soil with special reference to soil inoculation, R. S. MACDOUGALL (*Vet. Jour. and Ann. Comp. Path., 43 (1897), Feb., pp. 79–95*).

Remarks on the object and method of soil analysis, F. B. GUTHRIE (*Agl. Gaz. New South Wales, 8 (1897), No. 6, pp. 357–359*).—Brief general notes.

The conservation of moisture in sandy soils (*Deut. landw. Presse, 24 (1897), No. 67, p. 607*).—Sowing less seed than is customary in order to insure a light stand of grain is considered an effective method.

The formation and care of grass lands, G. MCCARTHY (*North Carolina Sta. Rpt. 1896, pp. 55–62, pl. 1*).—A reprint from Bulletin 125 of the station (E. S. R., 8, p. 307).

Influence of soil condition, M. J. RAULIN (*Ann. Soc. Agr. Sci. et Ind. Lyon, 7. ser., 4 (1896), pp. 287–301*).

The reclamation of reh or usar land, J. W. LEATHER (*Agl. Ledger, 1897, No. 7, pp. 9*).—Various methods of reclamation, including surface drainage, underdrainage by means of 2-inch pipes, and scraping off the surface reh, were tried without success, the second method failing because the pipes rapidly filled with silt. The planting of trees and flooding in connection with underdrainage was found to be an effective means of reclamation.

FERTILIZERS.

Analyses of commercial fertilizers, J. L. HILLS, B. O. WHITE, and C. H. JONES (*Vermont Sta. Buls. 58, pp. 35-47; 59, pp. 51-80*).—Notes are given on valuation, results of inspection in the State, the agreement between guaranties and analyses, the sources of potash and nitrogen in the different brands, the availability of organic nitrogen, and the relation between selling price and the commercial value of the plant food in the different fertilizers, together with tabulated analyses and valuations of 196 samples of fertilizing materials, including home-mixed and factory-mixed fertilizers, acid phosphate, nitrate of soda, tankage, bone, muriate of potash, sulphate of potash, muck, wood ashes, crematory ashes, and cotton waste. Bulletin 59 summarizes data previously published in Bulletins 57 (E. S. R., 9, p. 36) and 58 of the station.

"The station has analyzed [during the spring of 1897] samples of 134 distinct brands, the output of 20 companies, all drawn from dealers' stocks and (with one exception) this year's goods. The number of brands sold in the State is rapidly increasing. Two-thirds of the total number were above guaranty in every respect and five-sixths were essentially equal to or better than guaranty. Sixteen brands fell short more than 0.20 per cent in one, five were lacking in two ingredients, and one was below guaranty throughout. In one of the five cases both ingredients were seriously deficient. Shortages in one ingredient were not made good (commercially) by excess of other ingredients in seven brands, a part of the output of three companies. In one case analysis and guaranty were found to be widely apart in two ingredients, although an equivalent of plant food was given. Ninety-four per cent of the entire number of brands contained the commercial equivalent of their guaranties. One hundred and two brands were guaranteed (directly or inferentially) to contain potash as sulphate, a claim which was verified in but 17 cases.

"The application of pepsin digestion and Hayes-permanganate distillation methods to the several brands indicated that the class of materials furnishing organic nitrogen was almost without exception above reproach.

"The average 'valuation' was \$19.47 and the average selling price \$29.19, an advance of 50 per cent over valuation. One dollar out of every three invested in fertilizers paid for cost of manufacture and sale. A dollar spent for average low-priced goods (below \$29) bought 64 cts. worth of plant food; a dollar invested in average medium-grade brands (\$29 to \$35), 69 cts. worth; and a dollar paid out for average high-priced goods (\$35 and upward), 72 cts. worth.

"The average composition of the goods has not varied materially from that of last year. Selling prices are lower and plant food cheaper than ever before in the history of the trade."

The home mixtures, 5 samples of which were examined, "compared favorably in chemical composition and mechanical condition with the better class of mixed goods as found on the market. So far as heard from, the mixtures gave good results in the field." In 9 samples of muck the nitrogen varied from 1.4 to 3.13 per cent; in 11 samples of wood ashes the soluble potash varied from 2.45 to 8.21 per cent, and the total phosphoric acid from 1.8 to 5 per cent.

The fertilizer control station (*North Carolina Sta. Rpt. 1896, pp. X–XVI*).—This includes statements relating to the number and source of fertilizers examined during the year, the extent of the fertilizer trade in the State during 1894–'96, digest of fertilizer laws now in force, increase in number of brands and the difficulty in a proper control, the valuation of fertilizers, and a list of bulletins containing fertilizer analyses.

The number of brands of fertilizers sold in North Carolina in 1896 was 666 (as compared with 541 in 1895), classified as follows: Simple superphosphates, 107; superphosphates with potash, 68; ammoniated superphosphates, 398; ammoniated superphosphates without potash, 12; kainit, 34; other potash salts and chemicals, 13; animal bone, 16; fish scrap, 8; and miscellaneous, 10. Of these 666 brands, 213 were made in Virginia, 166 in North Carolina, 153 in South Carolina, 100 in Maryland, and the rest in other States, including Missouri, Illinois, New York, Massachusetts, and New Jersey.

The average actual and guaranteed composition of the principal classes of fertilizers sold in the State in 1896[1] are shown in the following table:

Composition of fertilizers on sale in North Carolina in 1896.

Kind of fertilizer.	Available phosphoric acid.		Ammonia.		Potash.	
	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Acid phosphates	13.25	11.95				
Acid phosphates with potash	10.47	9.26			2.01	1.91
Ammoniated superphosphates with potash	8.99	8.05	2.99	2.76	2.68	2.33

On the citrate solubility of phosphoric acid in ground bone' A. KELLER (*Chem. Ztg., 21 (1897), No. 33, p. 323*).—Ten-gram portions of bone meal were placed in beakers, covered with water, and allowed to stand in a room free from ammonia fumes for 4 months. Analyses of the material at the beginning and end of that period gave the following results:

Composition of fresh and decomposed bone meal.

	Original bone.	Decomposed bone meal.	
		Exposed to sunlight.	Protected from sunlight.
	Per cent.	*Per cent.*	*Per cent.*
Total phosphoric acid	23.62		
Citrate-soluble phosphoric acid	15.81	7.52	10.03
Total nitrogen	5.20	4.99	5.03
Ammoniacal nitrogen	.03	1.74	1.22
Fat	2.06		

These results show that there was a decided reversion of the citrate-soluble phosphoric acid and that a part of the organic nitrogen was converted into ammonia. It is suggested that the decline in citrate solubility was due to the formation of dicalcium-ammonium phosphate.

The author's investigations have indicated that the fat content is one of the most important factors in determining the quality of bone.

Field experiments with different commercial phosphates, C. A. GOESSMANN (*Massachusetts Hatch Sta. Rpt. 1896, pp. 190–194*).—These experiments were begun in 1890 (E. S. R., 8, p. 399). From 1890 to 1893, inclusive, phosphatic slag, Mona guano, Florida phosphate, and

[1] For composition of fertilizers sold in the State in previous years see E. S. R., 8, p. 879.

South Carolina phosphate (floats) were each applied annually at the rate of 850 lbs. per acre and dissolved boneblack was applied at the rate of 500 lbs., in connection with 250 lbs. of nitrate of soda and 390 lbs. of potash-magnesia sulphate. No applications of the phosphates have been made since 1893, but the applications of potash and nitrogen have been continued.

A summary of results for the whole period covered by the experiments is given in the following table:

Yields on plats fertilized with different phosphates, 1890 to 1896.

Plats.	1890. Potatoes.	1891 Wheat.	1892. Serradella.	1893. Corn.	1894. Barley.	1895. Rye.	1896. Soy bean.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Plat 1, phosphatic slag	1,600	380	4,070	1,660	490	695	254
Plat 2, Mona guano	1,415	340	3,410	1,381	405	630	233
Plat 3, Florida phosphate	1,500	215	2,750	1,347	290	383	262
Plat 4, South Carolina phosphate (floats)	1,830	380	3,110	1,469	460	759	252
Plat 5, dissolved boneblack	2,120	405	2,920	1,322	390	625	247

"The plat receiving dissolved boneblack leads in yield during the first two years, while the third, fourth, fifth, and sixth years the plats receiving phosphates insoluble in water are ahead, phosphatic slag being first, with South Carolina floats second."

Effect of chlorid of potassium on sulphate of ammonium in mixed fertilizers, C. A. GOESSMANN (*Massachusetts Hatch Sta. Rpt. 1896, pp. 222, 223*).—In the course of experiments at the station it was observed that fertilizer mixtures containing muriate of potash and ammonium sulphate invariably gave lower yields than those containing sulphate of potash and ammonium sulphate.

"As the season, character of the soil and mode of cultivation were practically the same in all cases it seemed but natural to conclude that the [first] fertilizers suffered an unfavorable change when incorporated in the soil. An actual trial proved that a dry mixture of muriate of potash and sulphate of ammonium dissolved in water changes into sulphate of potash and chlorid of ammonium (sal ammoniac). This form of nitrogen is known to act unfavorably on growing plants."

Deep stalls and the conservation of manure, C. BOYSEN (*Landw. Wochenbl. Schleswig-Holstein, 47 (1897), No. 34, pp. 486–488*).—The article discusses in a popular style the advantages and disadvantages of the deep-stall system of managing manure.

Green manuring (*Jour. Bd. Agr. [London], 4, No. 1, pp. 1–10, fig. 1*).—A critical review of that portion of the seventh series of Grandeau's *Études Agronomiques* dealing with the fixation of nitrogen by leguminous plants.

Lime and slag, L. GRANDEAU (*Jour. Agr. Prat., 61 (1897), II, No. 33, pp. 273, 274*).

Analyses of commercial fertilizers, M. A. SCOVELL, A. M. PETER, and H. E. CURTIS (*Kentucky Sta. Bul. 68, pp. 63–75*).—This includes brief explanations of the terms used in stating fertilizer analyses, notes on valuation of fertilizers, and tabulated analyses and valuations of 98 samples of fertilizers.

Fertilizer analyses, H. B. BATTLE (*North Carolina Sta. Special Buls. 46, pp. 175–178; 47, pp. 183–190*).—Tabulated analyses and valuations of 103 samples of fertilizers examined during May and part of June, 1897.

Fertilizer analyses, H. B. BATTLE (*North Carolina Sta. Rpt. 1896, pp. 5–31*).—A reprint of Bulletin 124 of the station (E. S. R., 8 p. 300).

The fertilizer control station (*North Carolina Sta. Biennial Rpt. 1895 and 1896, pp. 46–54*).—Reprinted from the Annual Report of the station for 1896 (see p. 336).

Compilation of analyses of fertilizers, H. D. HASKINS (*Massachusetts Hatch Sta. Rpt. 1896, pp. 225–241*).—The analyses are stated in percentages and pounds per ton.

Commercial fertilizers, C. A. GOESSMANN (*Massachusetts Hatch Sta. Bul. 45, pp. 16*).—Brief general remarks on the use of barnyard manure and commercial fertilizers; a schedule of trade values of fertilizing materials for 1897, with notes on valuation; the text of the State fertilizer law; a list of instructions to dealers in fertilizers; and tabulated analyses of 43 samples of fertilizing materials, including ashes, peat, muck, tankage, cotton-seed meal, cotton waste, ground bone, potash refuse, and mixed fertilizers.

Official inspection of commercial fertilizers and agricultural chemicals in 1896, C. A. GOESSMANN (*Massachusetts Hatch Sta. Rpt. 1896, pp. 202–220*).—The work of the station with reference to fertilizer control is briefly reviewed. The text of the State fertilizer law and a list of fertilizer manufacturers and dealers securing licenses under it in 1896 are given, with notes on Thomas slag as a fertilizer.

Analyses of licensed commercial fertilizers, F. W. WOLL (*Wisconsin Sta. Bul. 57, pp. 8*).—This bulletin gives tabulated analyses of 12 samples of fertilizers, accompanied by explanations of terms and notes on valuation.

The cost of plant food in Connecticut, spring months of 1897 (*Connecticut State Sta. Bul. 124, pp. 11*).—This bulletin discusses the commercial cost of plant food in nitrate of soda, sulphate of ammonia, cotton-seed meal, castor pomace, dissolved boneblack, dissolved rock phosphate, muriate of potash, sulphate of potash, sulphate of potash and magnesia, fish, bone, and tankage. The comparative availability and cost of the various forms of nitrogen are also discussed, and a schedule of trade values of fertilizing materials in Connecticut for the spring of 1897 is given.

Home-mixed fertilizers and composts, H. B. BATTLE (*North Carolina Sta. Bul. 139, pp. 59–72*).—The subject is discussed under the following heads: The need of home mixing of fertilizers and composts; how to proceed in home-mixing fertilizers; the advantages of compost making; when, how, and where to prepare the composts; how and when to apply; the use of stable manure alone or composted with other fertilizing materials; and cost of ingredients. Formulas are given for mixtures for cotton, corn, small grain, tobacco, grass, vegetables, sweet potatoes, peanuts, fruit, and cowpeas, and for top-dressing.

How to conduct field experiments with fertilizers, G. C. CALDWELL (*New York Cornell Sta. Bul. 129, pp. 139–147*).—This bulletin gives simple directions for conducting plat experiments with fertilizers. It is issued under the provisions of the Experiment Station Extension, or Nixon, bill.

Action of chlorid of potassium and chlorid of sodium on the lime resources of the soil, C. A. GOESSMANN (*Massachusetts Hatch Sta. Rpt. 1896, pp. 220, 221*).—A summary of results more fully reported in Bulletin 38 of the station (E. S. R., 8, p. 114).

Fertilizers and feeding stuffs regulations, 1897 (*Jour. Bd. Agr. [London], 4, No. 1, pp. 42–45*).

FIELD CROPS.

Report of the agriculturist, W. P. BROOKS (*Massachusetts Hatch Sta. Rpt. 1896, pp. 9–49*).—The report contains accounts of various field experiments, together with experiments with poultry, fungus diseases, etc. The field experiments are noticed below, and the other work is abstracted elsewhere.

Soil tests (pp. 12–14).—Soil tests with cabbages, Swedish turnips, and soy beans were carried out at the station, and soil tests with corn were made upon two other farms. The work with cabbages and Swedish turnips indicated the need of fertilizers particularly rich in available phosphoric acid and potash. Dissolved boneblack and muriate of potash were found to be useful forms of these fertilizers, but the author believes that other available phosphoric fertilizers would be as good as dissolved boneblack. A combination of these fertilizers seemed essential to a large increase of crop. The test with soy beans showed that potash had the greatest effect upon the increase and the quality of the crop. Muriate of potash was used, but it is stated that the sulphate has been found superior to it for beans. In the soil tests with corn potash was found to be the controlling element.

Manuring the corn crop (pp. 16–21).—Applications of 6 cords of barnyard manure per acre and 4 cords of manure with 160 lbs. of muriate of potash per acre were made annually during 6 years of corn culture on the same land. Manure alone gave the best results. Under the same conditions the mixed fertilizer corresponding in composition with the "special" corn fertilizers found upon the market in 1891 was compared with a fertilizer rich in potash but furnishing less nitrogen and phosphoric acid. The "special" fertilizer gave rather more grain and less stover, but the author considers the financial advantage to lie with the fertilizer richer in potash. In connection with these experiments hill and drill culture were tested. Drill culture produced the largest yield.

For green manuring in continuous corn culture white mustard sown in standing corn when last cultivated was found recommendable.

Variety tests (pp. 16–34).—Among 60 varieties of potatoes Carman No. 1, Fillbasket, New Satisfaction, Early Maine, and Dutton Seedling, in the order named, produced the largest yields. White Flint, Sanford, Compton, Early Giant, Long White, and Longfellow were the best among 21 varieties of flint corn. Yellow Rose, Mastodon, Reed Yellow Dent, New Golden Triumph, Leaming, and Sibley Pride of the North were the best among 46 varieties of dent corn.

Mammoth clover gave better yields than common red clover, and is recommended for sowing with timothy. Alsike and crimson clover proved to be short lived. The total yields and the amounts of dry matter contained are given in tables. Sulphate and muriate of potash were compared on clovers. The results are given in the following table:

Composition of clover hay grown with muriate and with sulphate of potash.

	Mammoth clover.		Common red clover.		Alsike clover.	
	Muriate.	Sulphate.	Muriate.	Sulphate.	Muriate.	Sulphate.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Water	16.81	16.88	17.92	14.26	26.05	21.64
Dry matter	83.19	83.12	82.08	85.74	73.95	78.36
	100.00	100.00	100.00	100.00	100.00	100.00
Dry matter contains—						
Crude ash	9.97	8.96	8.79	8.22	10.67	9.77
Crude fiber	30.35	30.40	31.46	30.24	30.32	30.23
Crude fat	2.00	2.18	2.66	3.15	2.07	2.08
Crude protein	14.65	14.86	13.34	12.61	16.48	15.82
Nitrogen-free extract	43.03	43.60	43.75	45.78	40.46	42.10

"In every instance the percentage of nitrogen-free extract is greater in the hay raised on the sulphate of potash." Japanese "barnyard" and Japanese "common" were found to be the best millets for seed production. Among 17 varieties of millet Japanese white panicle and Japanese barnyard millet produced the largest yields of hay.

Miscellaneous crops (pp. 34–42).—A number of these are reported upon. The flat pea, horse bean, and sachaline were not found valuable for that locality. Sorghum proved inferior to Indian corn as a fodder crop. Several other new crops proved unsuccessful. Three new varieties of field peas were tested, two rows 70 ft. long being grown of each. The different varieties were harvested at the same stage of maturity. The yields and composition are given in the following table:

Yield and composition of field peas.

Variety.	Total yield (pods filled but vines still green).	Water content.	Composition of dry matter.				
			Crude ash.	Crude fiber.	Crude fat.	Crude protein.	Nitrogen-free extract.
	Pounds.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
English Gray	156	85.23	9.56	30.23	3.16	20.65	36.40
Canada Beauty	200	81.72	7.80	28.99	2.74	16.14	44.33
Prussian Blue	205	81.94	....	....	....	....	....

The yields are given of several varieties of oats.

Sulphate of iron as a fertilizer (pp. 42, 43).—Sulphate of iron was applied at the rate of 80 lbs. per acre to 2 plats of green soy beans. The difference in favor of the treated plats over the untreated plats was at the rate of 525 lbs. per acre, the crop being cut green for the silo. "It has been claimed by Griffiths[1] that the use of this salt favors chlorophyll formation, and that it therefore causes a perceptibly deeper shade of green in the leaves of the plants to which it is applied. No difference could be detected during the season."

Trial of hay caps (p. 45).—Three kinds of hay caps were used at the station—Symmes paper board, oiled cotton, and cotton impregnated with tannin. The author states that the Symmes cap is most readily applied, and that the cloth caps impregnated with tannin are more durable than those of oiled cotton. Clover which was cocked quite green and stood for a time with frequent rains kept best under the cloth caps. "The porosity of the former in such cases appears to be an advantage."

Forage crops, I. P. ROBERTS and L. A. CLINTON (*New York Cornell Sta. Bul. 135, pp. 271–296*).—Experiments with corn, oats and peas, barley and peas, millets, and clovers as forage crops were made in 1895 and 1896. The cultivation of these crops is briefly stated, and the results of experiments are given in tabular form. The table following gives the results with different methods of seeding corn.

[1] Griffiths, Farm manures.

Results from different methods of seeding corn, 1895 and 1896.

Manner of planting.	Yield per acre (average of 2 years). Stalks.	Grain.	Total.	Composition of crop in 1895. Moisture.	Dry matter.	Protein.	Fat or ether extract.	Nitrogen-free extract.	Fiber.	Ash.	Estimated value per acre.[1]
	Lbs.	*Lbs.*	*Lbs.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	
Hills	17,070	5,648	22,718	68.67	31.33	2.83	0.88	19.92	6.42	1.28	$73.31
Drilled	19,815	4,384	24,199	71.16	28.84	1.83	.68	18.13	6.94	1.26	66.83
Broadcast	29,586	None.	29,586	76.42	23.58	1.38	.60	14.04	6.37	1.19	68.17

[1] Protein, 2.3 cts. per lb.; fat, 1.14 cts. per lb.; nitrogen-free extract and fiber, 0.94 ct. per lb.

While broadcasting gave the largest total yield of forage, the feeding value of the product was lower. The tillage which can be given corn planted in hills is considered an important factor, as it conserves moisture and enables the crop to mature, while in the case of broadcasting the moisture supply of the soil is soon exhausted. To determine the best time for cutting analyses of the crop were made at different times, and from these the yield of constituents was calculated as follows:

Yield per acre of green corn fodder and constituents when cut at different stages of maturity.

Date of cutting.	Stage of maturity.	Green forage.	Water content.	Dry matter.	Crude protein.	Ether extract.	Nitrogen-free extract.	Crude fiber.	Ash.
		Lbs.	*Per ct.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
August 2	In bloom	24,805	85.25	3,658	361	98	2,124	807	268
August 17	In milk	27,830	87.31	3,810	344	65	2,200	957	244
August 31	Roasting ear	30,250	82.56	5,274	467	103	2,912	1,499	293
September 10	do	28,980	81.37	5,398	333	133	3,188	1,466	278
September 24	Mature	30,108	69.75	9,109	686	224	5,598	2,282	319

The work of other stations confirming these results is briefly described.

Data are given for the yield and composition of mixtures of oats and peas, oats and barley, and for oats and barley grown alone. The author ranks oats and peas next to corn as a forage crop. For late forage barley is recommended instead of oats, as it makes a better growth in late summer. A table shows that mixed oats and peas are relatively rich in protein and ash as compared with oats, barley and oats, and barley. "Oats and peas furnish a larger percentage of ash than any of the other forage crops grown by us."

Samples of the roots and tops of crimson, red, and medium clover were taken November 2 and the nitrogen determined. The results follow:

Amount of nitrogen stored up by different varieties of clover.

Variety.	Nitrogen in tops.	Nitrogen in roots.	Total nitrogen per acre.
	Pounds.	*Pounds.*	*Pounds.*
Crimson clover	125.28	30.66	155.94
Red clover	63.11	40.25	103.36
Mammoth clover	67.57	78.39	145.96

The clovers wintered well, but the freezing and thawing in the spring killed nearly all of the crimson clover. It had proved valuable for late fall pasture and as a cover crop.

Some remarks are made on Hungarian grass, millet, sorghum, teosinte, and sachaline.

Fertilizer analyses of castor-bean plant, G. L. HOLTER and J. FIELDS (*Oklahoma Sta. Bul. 25, pp. 7, 8*).—The authors report analyses with reference to the fertilizer constituents of the different parts of the castor bean, as follows:

Fertilizer analyses of castor bean.

	Water.	In dry substance.		
		Nitrogen.	Phosphoric acid.	Potash.
Leaves, small branches, and fruit:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
June 19	81.05	4.17	1.14	4.21
July 6	81.32	3.88	1.01	3.94
July 31	80.46	3.60	.78	3.39
September 29	80.56	3.20	.65	2.67
Average	80.85	3.71	.89	3.55
Stalks and roots:				
June 19	85.10	1.28	.73	3.62
July 6	83.93	1.04	.35	3.21
July 31	80.02	.70	.17	2.56
September 29	78.09	.93	.24	1.69
Average	81.78	.99	.37	2.77
Beans	4.40	3.62	1.43	.69
Pods and pod stems	8.24	2.54	.11	6.51

Potato culture, I. P. ROBERTS and L. A. CLINTON (*New York Cornell Sta. Bul. 130, pp. 151–163*).—Culture experiments were made in 1895 and 1896 to ascertain the possibilities of rendering available the fertilizing materials of the soil and to note the effects of tillage on the crop. Cultivation was continued until there was danger of injuring the plants. The plats were one-twentieth of an acre in size and had all been subject to the same cultivation and rotation. In 1895 the same thorough cultivation was given all plats until the plants showed themselves above ground, after which some plats received 13 cultivations and the remainder 9 cultivations. The average yield for 13 cultivations was 337.5 bu. and for 9 cultivations 367.5 bu. per acre. In 1896 the experiment was continued on a larger scale, and 3, 6, 7, and 11 cultivations were given to various groups of plats. The plats receiving 7 cultivations produced the largest average yield—343.1 bu. per acre. Commercial fertilizers gave no beneficial results on account of a lack of moisture. It is shown that with a soil containing little more than half the amount of potential plant food ordinarily contained in soil a yield was secured from 3 to 4 times the average yield of the State. Analyses showed that 4,008.8 lbs. of phosphoric acid and 11,329.8 lbs. of potash were locked up in the gravel of a surface foot of 1 acre of land. The authors consider that the mineral elements were made more available by frequent tillage.

The conservation of moisture is discussed. The plants were kept in a healthy condition by spraying. The authors conclude that sufficient stored-up plant food exists in most arable soils, and that by making it available and conserving the moisture by frequent level culture the average yield for the State can be largely increased. They also emphasize the necessity of keeping the foliage healthy.

The sugar beet: Culture, seed development, manufacture, and statistics, H. W. WILEY (*U. S. Dept. Agr., Farmers' Bul. 52, pp. 47*).—The theoretical beet-sugar belt of the United States—a zone of varying width, through the center of which passes the isothermal line of 70° F. for the months of June, July, and August—is shown upon a map. Descriptions and illustrations of the best varieties of sugar beets are given.

With regard to moisture, it is stated that the best soils are those having good drainage and good capillarity. Warm autumnal showers induce a new growth, thereby diminishing the sugar content of the beet crop.

The author states that soils which produce good crops of corn, wheat, or potatoes will, under proper cultivation, produce good crops of sugar beets. The following shows the amounts of nitrogen and ash constituents removed by 1,000 lbs. of entire plants:

Fertilizing constituents in 1,000 pounds of beets and beet leaves.

	Roots.	Leaves.
	Pounds.	*Pounds.*
Potash	3.3	6.5
Phosphoric acid	.8	1.3
Magnesia	.5	3.0
Nitrogen	1.6	3.9
Total ash	7.1	18.1

As the leaves contain considerable quantities of these constituents, it is thought best to leave them upon the field.

Barnyard manure is recommended to be applied one or two seasons before the sugar beets are grown, as fresh applications reduce the sugar content. Heavy nitrogenous manures injure the quality of the beet, not so much by decreasing the sugar content as by increasing the percentage of nonsugars.

The growing of sugar beets in rotation is considered desirable, and a rotation of wheat, beets, clover (one crop of which is cut for hay and the second crop plowed under), and potatoes is recommended.

The author recommends late fall plowing at least 9 in. deep and subsoiling to the depth of 6 or 7 in. more. Thorough surface cultivation should be given before planting, which should be done as early as possible, as early-planted beets give a larger yield and a higher content of sugar than late-planted beets. The operations of planting, cultivating, and harvesting are described in detail and illustrations given of suitable implements.

An estimate is made of the cost of growing beets with land at $75 per acre, labor at $1 per day, and the distance to the factory not more than 3 miles. On this basis the cost per acre is given as $59.50, and the return, with a yield of 15 tons of beets per acre, at $4.50 per ton, is given at $67.50.

Several estimates by other persons are given for comparison.

Seed development.—The process underlying the production of high-grade beets is outlined. The "mothers" or plants retained for seed should be smooth and regular in shape. They should weigh from 20 to 24 oz. and be selected from beets of the best quality. The leaves are to be removed without injuring the neck and the roots ensiled during the winter. In the spring the sugar content and the coëfficient of purity of each root having a specific gravity above a certain point are determined, and the selected beets are then planted and a record kept of each beet. The seed produced is used solely for the production of the seed of commerce in the fourth or sixth year from the parent. Experiments indicate that domestic seed is better than foreign-grown seed.

Manufacture.—The process of beet-sugar manufacture is described, and illustrations of the machinery are given. In view of the elaborate process and costly machinery, the author discourages the idea of producing beet sugar on the farm, but points out the advantages of coöperative factories. It is estimated that sugar can be made in this country at a cost of from 3 to 4 cts. per pound.

Statistics.—Tables show the increase in the production of beet sugar in the United States, the production and consumption of sugar in various countries, and other interesting information on the subject.

Report of field experiments with tobacco in Massachusetts, 1893-'96, C. A. GOESSMANN (*Massachusetts Hatch Sta. Bul. 47, pp. 31*).—Coöperative fertilizer experiments were carried on for 3 years at Hatfield, Agawam, and Westfield, Massachusetts. Various fertilizer mixtures were used, containing in all cases 300 lbs. of potassium oxid, 100 lbs. of nitrogen, and 60 lbs. of phosphoric acid per acre in available forms. One-fourth of the nitrogen was in the form of nitrates of soda or potash, to make the nitrogen uniformly available during early growth. Ingredients containing chlorin were excluded from all fertilizers. In the field 10 plats were fertilized with commercial fertilizers and two with barnyard manure.

The composition is given of the fertilizing materials used.

The yearly results obtained with different fields are tabulated, and a summary of the whole work is given. The yield, quality of ash, fire-holding capacity, and the rank of the plats is reported.

It is concluded that the different fertilizers affected the quality of the crop more than the weight.

Cotton-seed meal, linseed meal, and castor pomace, when used with sufficient nitrate of soda or nitrate of potash to furnish one-fourth of the nitrogen needed, proved equally good as sources of nitrogen for tobacco. Nitrate of soda, used with acid phosphate or dissolved bone-black, gave better results than nitrate of potash under similar conditions. Cotton-seed hull ashes and high-grade sulphate of potash proved to be the most valuable sources of potash in these experiments. Nitrate of potash, when used with an alkaline phosphate or with carbonate of potash and magnesia, gave good results.

"Any attempt at classifying the various fertilizers used with reference to their superior fitness can not be otherwise than somewhat arbitrary." The author makes the following classification:

First class:

Nitrate of soda, cotton-seed hull ashes, castor pomace.

Nitrate of soda, cotton-seed hull ashes, cotton-seed meal.

Nitrate of potash, cotton-seed hull ashes, cotton-seed meal.

Nitrate of potash, carbonate of potash-magnesia, phosphatic slag.

Second class:

Nitrate of soda, high-grade sulphate of potash, cotton-seed meal, dissolved boneblack.

Nitrate of soda, high-grade sulphate of potash, linseed meal, dissolved boneblack.

Nitrate of soda, high-grade sulphate of potash, castor pomace, dissolved boneblack.

Third class:

Nitrate of potash, potash-magnesia sulphate, cotton-seed meal, dissolved boneblack.

Nitrate of potash, potash-magnesia sulphate, castor pomace, dissolved boneblack.

The observations with barnyard manure are considered insufficient in number to warrant conclusions.

Experiments with wheat, 1896–'97, G. E. MORROW and J. H. BONE (*Oklahoma Sta. Bul. 28, pp. 8*).—Experiments were conducted to ascertain the effects of time and rate of seeding and the effect of subsoiling. A comparison of 64 varieties was made on 83 plats. Results are given in tables.

In the variety tests the plats (usually one-fortieth of an acre in size) were sown September 22 to 24, at the rate of 4 pecks per acre. The average yield was 39.6 bu. per acre, the yields ranging from 19.5 bu. to 57 bu. "The varieties giving largest yields were Fultz, Red Russian, Fulcaster, Mealy, Dietz Longberry, Sibley New Golden, and Oregon Swamp, but it is probable other things influenced the yield more than did the variety."

Wheat was sown at different dates from September 15 to November 16, and at the rate of 3, 4, 5, 6, and 8 pecks per acre. The largest yields were obtained from the first sowing—September 15—and generally the best results were secured from sowing at the rate of 6 pecks of seed per acre.

A trial of subsoiling showed only a small effect on the yield.

Loss by exposure of corn stover and teosinte, G. L. HOLTER and J. FIELDS (*Oklahoma Sta. Bul. 25, pp. 3, 4*).—In order to learn whether exposure to sun, rain, and wind caused a loss of nutritive material analyses were made of samples of corn stover and teosinte from the inside and outside of the shocks which had stood in the open field all winter. The results were as follows:

Composition of corn stover and teosinte from inside and outside of shock.

	Water in fresh substance.	In dry substance.				
		Protein.	Nitrogen-free extract.	Fat.	Crude fiber.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Corn stover:						
Outside of shock	9.70	4.87	46.59	0.95	40.34	7.25
Inside of shock	10.36	7.87	44.46	1.13	38.51	8.04
Teosinte:						
Outside of shock	13.23	9.01	43.71	1.34	33.30	12.64
Inside of shock	12.41	13.25	42.81	2.42	29.96	11.56

In the authors' opinion, fully one-fourth of the feeding value of corn stover and one-third of the feeding value of teosinte is lost by exposure.

"This loss can be largely prevented by stacking the fodders, either by placing in stacks with only the butts of the stalks exposed or by placing in long, narrow shocks and feeding from one end. By this method the amount of fodder exposed to the action of the weather and the consequent loss is reduced to a minimum."

Report of the agriculturist, W. C. LATTA (*Indiana Sta. Rpt. 1896, pp. 18–27*).—This is a brief statement of the work of the year, with summarized results based partly on previous data.

Out of 8 varieties of wheat under trial for 1 to 13 years, Michigan Amber, Willett, and Velvet Chaff are the more promising, and out of 27 varieties of oats under trial 1 to 8 years, the more promising sorts are Black, American Banner, White Russian, and Black Prolific. Sowing 7 pecks of wheat per acre produced a higher average yield for 12 years than sowing quantities ranging from 2 to 8 pecks. Early and late sowing of wheat under trial 8 years shows that September 18 to 20 is the preferable date. The growth of a number of grasses and legumes is described. *Lathyrus sylvestris* is "an exceedingly slow grower at this station," and is not considered valuable as a crop in rotation. In 1883–'84 fresh horse manure was applied to alternate plats, amounting for the 2 years to about 50 tons per acre. Corn has been continuously grown on these plats since 1880. The average increased yield per acre over the unmanured plats was more than 10 bu. per acre, and the increase for 1896 was 3 bu. per acre, showing that the manure was still effective.

Rotative cropping and continuous grain growing for 15 years has led to the conclusion that larger crops can be secured and the fertility of the soil better conserved by judicious rotations. Light applications of manure have proved more profitable than heavy applications. Tables give the yields per acre of corn and Kafir corn and the results of coöperative variety tests. Home-grown varieties of corn are considered more satisfactory than those from other localities.

Preventing barley from sprouting when in the sheaf (*Deut. landw. Presse, 24 (1897), No. 67, p. 608, fig. 1*).—A description of a method of placing the sheafs to insure rapid drying and to keep the heads from the ground.

The cost of growing corn (*Amer. Agr. (middle ed.), 60 (1897), No. 11, pp. 242, 243*).—A calculation based on the records kept by growers in eight States.

Cotton culture in the United States (*Mitt. deut. landw. Gesell., 12 (1897), No. 15, Suppl., pp. 83–88*).

The manuring of cotton (*U. S. Dept. Agr., Farmers' Bul. 48, pp. 16*).—This is an abstract of an article in Office of Experiment Stations Bulletin 33 (E. S. R., 8, p. 686). The draft of the cotton plant on the fertility of the soil is discussed and the results of experiments on the manuring of cotton conducted at a number of the experiment stations are given.

The effect of fog and evaporation from the soil upon Egyptian cotton, DAVID (*Ztschr. Pflanzenkrank., 7 (1897), No. 3, pp. 143–149*).

The composition and storing of hops (*Deut. landw. Presse, 24 (1897), No. 64, pp. 580, 581*).—An article discussing the various fungus diseases which attack hops when stored and the methods to prevent them. The composition of the hop is given.

Tests of forage grasses, G. MCCARTHY and F. E. EMERY (*North Carolina Sta. Rpt. 1896, pp. 37–54, 75–87, figs. 18*).—A reprint from Bulletin 125 of the station (E. S. R., 8, p. 302).

Some new forage, fiber, and other useful plants, G. MCCARTHY (*North Carolina Sta. Rpt. 1896, pp. 339–353, figs. 5*).—A reprint of Bulletin 123 of the station (E. S. R., 8, p. 41).

Field notes on some Nevada grasses, F. H. HILLMAN (*Nevada Sta. Bul. 33, pp. 13*).—Popular descriptions are given of *Oryzopsis membranacea, O. webberi, Stipa speciosa, S. cornata, S. stricta, S. occidentalis, Elymus triticoides, E. sitanion*, and *Festuca microstachys.*

Observations with leguminous crops at Amherst, C. A. GOESSMANN (*Massachusetts Hatch Sta. Rpt. 1896, pp. 182–189*).—Experiments were conducted with 21 different legumes.

Alfalfa and crimson clover suffered severely from late frosts in spring.

Mixed crops of peas, vetch and horse bean, and vetch and oats or barley have generally given good returns.

Soy beans yielded large crops during average seasons. Liberal manuring with nitrates interfered with the development of the root tubercles on well-infected soil.

Results of previous work along this line have been given in a former report (E. S. R., 8, p. 393).

Field experiments on leguminous crops in rotation, C. A. GOESSMANN (*Massachusetts Hatch Sta. Rpt. 1896, pp. 172–177*).—Since 1892 soy beans have been grown in rotation with a grain crop on a plat of land without nitrogenous fertilizer. The results indicate that the introduction of the leguminous crop into the rotation somewhat reduced the difference in yield between the plats receiving no nitrogen and those receiving it, but did not entirely obliterate it. The experiments are to be continued, medium red clover being substituted for soy beans.

Potatoes, A. W. SUTTON (*London: Simpkin, Marshall, Hamilton, Kent & Co., 1895, pp. 44, figs. 49*).—A lecture delivered before the Royal Horticultural Society and reprinted from vol. 9, part 3, of the journal of the society.

Irish potatoes, C. L. NEWMAN (*Arkansas Sta. Rpt. 1896, pp. 3–16*).—A reprint of Bulletin 38 of the station (E. S. R., 8, p. 125).

Sorghum as a forage crop, T. A. WILLIAMS (*U. S. Dept. Agr., Farmers' Bul. 50, pp. 20, fig. 1*).—This bulletin gives the general characteristics and origin of the sorghum plant and describes the methods of culture and the uses for forage. Concerning the value of sorghum for forage the author summarizes as follows: "Sorghum may be used for soiling, pasturage, hay, and silage. It is especially valuable as a pasturage for lambs and hogs and as a summer and autumn feed for dairy stock. Feed sparingly until the stock become accustomed to it.

"The best quality of hay is obtained by cutting the sorghum shortly after it begins to bloom. When used for soiling cutting may be profitably begun as soon as the heads are formed. The common practice is to cut for silage when the seed is in the 'dough.'

"The forage contains an excess of fat-forming substances and should be fed in connection with foods rich in muscle-making materials. The seed is usually fed with the stems and leaves. Thrashed seed should be crushed or ground and mixed with wheat bran, oats, or other nitrogenous foods."

Sugar beets, N. E. WILSON (*Nevada Sta. Bul. 32, pp. 47*).—This bulletin is a review of the beet experiments conducted at the station since 1891. Part of this work has been reported in previous bulletins (E. S. R., 6, 411).

Sucrose content and purity of the several varieties harvested at different dates from August 27 to October 29; gain or loss in sucrose, solids, and purity between the dates of harvesting; a summary of beet analyses made at the station from 1891 to 1896; and daily meteorological conditions during the harvesting period are given in tables.

Culture of sugar beets and sugar manufacture, P. RAUSCENT (*Jour. Soc. Agr. Brabant-Hainaut, 1897, No. 10*).

The tobacco industry in Germany, G. LEWINSTEIN (*Volkswirthschaftliche Zeitfragen, 18 (1897), Nos. 6–7, pp. 69*).—The development of the industry is outlined and the varieties of tobacco used are described.

Barn-curing tobacco (*Florida Farmer and Fruit Grower, 9 (1897), No. 39, p. 534*).

Field experiments at Ghent, Belgium, P. DE CALUWE (*Exposé Cult. Exper. Jard. Gand, 1895–'96, pp. 106, pls. 3*).—These experiments include variety and fertilizer tests with rye, wheat, barley, maize, legumes, chicory, and potatoes. Fertilizer experiments were made with beets, sugar beets, turnips, and grasses. Several experiments with phosphatic and nitrogenous fertilizers are reported. Meteorological observations for the whole year are given.

In the experiments with oats and barley the seed was sorted into very large, large, and small grains. The difference in seed had no effect on the yield of Hanna barley, but with the Chevalier variety the small seed produced the most grain. With oats the very large seed produced a little the largest yields.

Field and other experiments at Rothamsted, Sir J. B. LAWES (*Mem. Rothamsted Expts., 1897, pp. 111*).—This is the fifty-fourth annual memoranda of the origin, plan, and results of the experiments conducted on the farm and in the laboratory at Rothamsted, England, being a report to the Lawes Agricultural Trust Committee.

Experiments on pasture, 1896 (*Agr. Students' Gaz., 8 (1897), No. 4, pp. 109–111*).—Fertilizer experiments in which the same manures have been applied to a number of the plats for 10 years in succession. The results are given in tables.

Haying tools and hay making, F. E. EMERY (*Arkansas Sta. Rpt. 1896, pp. 63–74, figs. 24*).—A reprint from Bulletin 125 of the station (E. S. R., 8, p. 307).

The influence of the proportion of fertilizing elements on the yield, M. J. RAULIN (*Ann. Soc. Agr. Sci. et Ind. Lyon, 7. ser., 4 (1896), pp. 302–309*).

Rotations and seasons, G. HEUZÉ (*Jour. Agr. Prat., 61 (1897), II, No. 34, pp. 308, 309*).—A popular article outlining 3 and 6 year rotations.

Manual of farm crops, P. DE VUYST (*Manuel des cultures spéciales. Paris: O. Doin, 1897, pp. 264, figs. 29*).—A practical manual treating of the culture of root crops, cereals, and forage crops; the methods and values of rotations, and the preparation of meadows. The author's endeavor has been to make the book practical and to point out the benefits which can be derived from the application of theories to practice. With this end in view, matters of a purely scientific interest have been avoided, but the discussion of each subject is based upon the opinions and numerous experiences of recognized scientific authorities, including the author.

The subjects of manures and varieties are given prominence, as they are considered the most important from a practical point of view. For the benefit of all, and students especially, the subjects are treated in a uniformly methodical manner.

HORTICULTURE.

Experiments with fertilizers on celery, B. M. DUGGAR and L. H. BAILEY (*New York Cornell Sta. Bul. 132, pp. 221–230, figs. 7*).—This is a report of an experiment conducted near Rome, New York, on muck land which had been previously a half-wild meadow and had never received fertilizers. Fertilizers were spread by hand in small furrows on both sides of rows of celery. The varieties grown were Golden Self-Blanching, Kalamazoo, and White Plume. The fertilizers used were sulphate of potash, muriate of potash, dissolved South Carolina rock, boneblack, nitrate of soda, and a combination of nitrate of soda, sulphate of potash, and dissolved South Carolina rock. Several rows of plants received no fertilizer. The number of rows in each plat, the weight of fertilizers applied to each, and the weight of 6 average plants in each are reported. Brief notes are given of the behavior of the plants under different modes of treatment. Plants from some of the plats are figured.

The results of this test are summed up by the authors as follows: "All these records show that wood ashes gave the best results, although a combination of nitrate of soda, South Carolina rock, and sulphate of potash promises to do well. Muriate of potash excelled the sulphate. Nitrate of soda alone gave poor returns. The check (no fertilizer) plats were not worth the growing."

Chemical analyses of the soil and of an average plant from each plat are given in tabular form. Nitrates were found in appreciable quantities in plants fertilized with nitrate of soda and in those fertilized with nitrate of soda, sulphate of potash, and South Carolina rock. Phosphoric acid and lime were fairly constant in all the plants. Potash was the most variable constituent. With one marked exception a greater percentage of potash was found in the plants fertilized with it than in those not so fertilized. In some samples there seemed to be evidence that potash was partially replaced by soda. The soil was found to show no acidity and to contain a high percentage of nitrogen, potash, and phosphoric acid. The phosphoric acid was in a very available condition, but the potash was practically all unavailable, which the authors say "seems to explain the excellent results which were obtained from the wood ashes."

Vegetables old and new, L. R. TAFT, H. P. GLADDEN, and M. L. DEAN (*Michigan Sta. Bul. 144, pp. 209–244*).—The bulletin gives the results of tests of several hundred varieties of vegetables in 1896. The report is given partly in the form of brief notes of varieties and partly in tables showing such data as yield, average weight, time of blooming and maturity, etc. Data are given for 31 varieties of lettuce, 4 of kale, 2 of kohl-rabi, 40 of cabbage, 31 of bush beans, 34 of peas, 32 of radishes, 31 of onions, 12 of beets, 163 of potatoes, 71 of tomatoes, 10 of squash, 12 of cucumbers, and 32 of sweet corn.

In some cases varieties are specially recommended as follows: Cabbage: Early varieties—Saltzer Lightning, Wakefields, Henderson Early Summer, Bloomsdale Early Market, and Early Flat Dutch; medium varieties—Succession, All Seasons, Reynolds, and Early Drumhead; winter varieties—Drumheads, Flat Dutch, and Rock Heads. Bush Beans: Valentine Wax, Keeney Golden Wax, Cylinder Black Wax, Flageolet Victoria, Red Valentine, Stringless Green Pod, and Dwarf Horticultural. Radishes: Long Scarlet Short Top, Rose China, White Vienna, and Yellow Summer Turnip. Beets: Egyptian, Eclipse, Bassano, Shull Model Blood Turnip, and Long Blood. Potatoes: Early varieties—Irish Cobbler, Early Pride, Early Michigan, Early Norther, Early Pinkeye, Early Walton, Early Woodbury, and Quick Crop; medium early varieties—Rose No. 9, Early Bell, Good News, and Acme; medium late varieties—Livingston Banner, Country Gentleman, Wise Seedling, Napoleon, Lakeside Champion, Rutland Rose, Inability, Rural New Yorker No. 2, Supplanter, Troy Seedling, and Vanguard; late varieties—Enormous, Champion, Fottler Peachblow, Maggie Murphy, Carman No. 3, Cayuga, Great Divide, Hicks 22, Hicks 101, White Manhattan, White Prize, and World's Fair. Tomatoes: Vaughan Earliest, Advance, Ruby, Atlantic Prize, Acme, Beauty, Ignotum, Perfection, Potato-leaf, and Optimus. Cucumbers: Russian, Cluster, Commercial Pickle, Green Prolific, White Spine, Long Green, Albino, and Eskimoso.

The peach industry in Pennsylvania, G. C. BUTZ (*Pennsylvania Sta. Bul. 37, pp. 29, figs. 14*).—The bulletin deals in a popular way with the status of the peach industry in Pennsylvania, the factors of success and failure and the profits in peach growing, the selection of soil and location, the planting, cultivation, and manuring of orchards, the pruning of trees, the thinning, picking, and marketing of fruit, the selection of varieties, and the diseases and enemies of the peach. The author estimates the total peach area of the State at 11,000 acres, practically confined to the southeast quarter of the State, and very largely concentrated in 3 or 4 counties.

Trees on exposed hilltops are found to suffer less from winterkilling than those in protected valleys, probably on account of better maturity of the wood in the former locations. Disintegrated sandstone or shale soil is found to be best suited to peaches. The usual limit of profitable life of an orchard is given as about 12 years. Pruning so as to form low, spreading heads is favored. Thinning the fruit is strongly recommended. The borer is the most injurious insect enemy of the peach. Cutting it out with a knife is recommended.

Notes upon plums for western New York, S. D. WILLARD and L. H. BAILEY (*New York Cornell Sta. Bul. 131, pp. 169–195, figs. 12*).—*General remarks, L. H. Bailey.*—The following types of plums are noted: European (*Prunus domestica*), Myrobalan (*P. cerasifera*), Japanese (*P. triflora*), Apricot (*P. simonii*), Americana (*P. americana*), Wild Goose (*P. hortulana*), Chickasaw (*P. angustifolia*), Sand (*P. watsoni*), Beach

(*P. maritima*), and Pacific Coast (*P. subcordata*). The paper has to do principally with the European and Japanese types. The former are classified loosely into 4 groups—the Damsons, Green Gages, Large Yellow, and Large Colored plums. The European and Japanese types are found to be about equally hardy, and both are thought to be self-fertile. The American types are much hardier than either, but are of poorer quality than the European type. The Japanese plums are valuable for their earliness, firm fruit, vigor, and productiveness. They are less liable to fungus diseases than the European plums.

The present status and future prospects of plum culture are noted. Soils, stocks, planting and pruning, insect and fungus enemies, and varieties are briefly discussed.

Varieties of plums in western New York, S. D. Willard.—This is a report embodying 25 years' experience with varieties of plums grown on a commercial scale. Descriptive notes are given on about 70 varieties, a number of which are illustrated.

Report of the horticultural department, J. Troop (*Indiana Sta. Rpt. 1896, pp. 44–48*).—Brief notes are given on 19 varieties of cherries and 5 varieties of plums.

Close root pruning.—Two trees each of standard pear, dwarf pear, cherry, prune, peach, and quince were close pruned, all but an inch or two of the roots and all of the top being removed. Two trees of each were pruned in the ordinary way. The trees were photographed before planting and were taken up and photographed after the season's growth. The author says, "The result of this experiment showed that the peach was capable, after being deprived of all its roots and branches, of producing a magnificent root system and a top to correspond. The dwarf pear, the standard pear, German prune, and Early Richmond cherry came next in order, the latter making very little root development on the pruned trees."

Dendrolene as an insecticide.—Dendrolene is reported as killing peach and apple trees when applied to keep out borers. The trees began dropping their leaves in about 3 months after the application of the Dendrolene. A little later the cambium was found to be killed, and in 5 months from the time the application was made most of the trees were dead. Peach trees were affected worse than apple trees and young trees worse than old ones.

Bees vs. grapes.—A test was made to determine whether honey bees damaged grapes by puncturing the skins and sucking the juice. A colony of bees was placed near a grapevine and both vine and bees covered with mosquito netting so as to allow plenty of room for the bees to fly about. The bees were kept confined for 3 weeks till the grapes became thoroughly ripe. The grapes were uninjured by the bees. On the outside of the netting, however, wasps were observed to cut the skins and suck the juice of the grapes. The experiment was reported previously in American Gardening (E. S. R., 8, p. 601).

Fruit tests at South Haven, T. T. Lyon (*Michigan Sta. Bul. 143, pp. 165–207*).—Tabulated data are given for 161 varieties of strawberries, 60 raspberries, 31 blackberries, 23 currants, 20 gooseberries, 78 cherries, 216 peaches, 143 grapes, 79 plums, 44 pears, 102 apples, and 11 quinces. The tables show the time of planting, season of blooming, period of fruiting, vigor and productiveness of plants, quality and size of fruit, and similar data. Brief accounts of the treatment of the various fruits and descriptive notes on varieties accompany the tables in most cases. In some instances unfavorable conditions rendered the results less valuable than they otherwise would have been.

In regard to the attacks of the curculio on plums and peaches the author says: "Experience here quite clearly indicates the wisdom of planting plums and peaches adjacent and using the former as a curculio trap." Brief notes are given on almonds, chestnuts, hazelnuts, pecans, walnuts, apricots, mulberries, nectarines, asparagus, and rhubarb.

The Loganberry, L. F. Kinney (*Rhode Island Sta. Bul. 45, pp. 67–82, figs. 8*).—Historical notes are given on the introduction of the Loganberry, together with a sketch of its origin furnished by Judge Logan, of California. Methods of growing and propagating the berry are discussed and illustrated. The fruit, flowers, and plant are figured.

The fruit ripens in Rhode Island about with the raspberry. It is found to be not highly flavored when eaten fresh, but to excel both blackberry and raspberry as a sauce when cooked. The plant is propagated naturally and most readily by stolons, though somewhat less readily so than black raspberries. It may be also grown from hardwood cuttings. Plants grown from seed retain the general character of the parent plant, but as a rule produce very inferior fruit.

Strawberries under glass, C. E. Hunn and L. H. Bailey (*New York Cornell Sta. Bul. 134, pp. 263–268, pl. 1*).—Strawberry plants were started in 2½-in. pots, plunged under runners in the field during July and August. In about 2 weeks after starting they were transferred to 4-in. pots and placed in cold frames, which were without glass until very cold weather. The plants were again shifted to 5-in. pots and finally to 6-in. ones.

Toward the last of December 450 pots were taken to a cool house (temperature 40 to 45° at night). The plants began blossoming about February 1, and about a week later were transferred to a warm house (65° at night). The first picking was made March 11. Ripening continued for 10 days. The flowers were hand pollinated every pleasant day. Liquid manure was applied to the plants twice a week from the time the berries were well set until they were about full-grown. For holding berries up from the earth and pots, small pieces of fine wire screen were found to be better than cork dust or sphagnum moss.

Two other lots of plants were taken into the house later in the winter and received essentially the same treatment as the first lot. The first lot was composed principally of Beder Wood, the second and third lots of Sharpless, Van Deman, Beder Wood, and Hunn. Beder Wood gave the best results. It has the advantage of being perfect flowered, early, and having a comparatively small amount of foliage. Its disadvantage is the light color of its berries. The Beder Wood of the first lot averaged 6 berries per plant. From 8 to 12 plants yielded a quart of fruit.

The prices and demand for winter-grown strawberries are noted. The authors recommend starting with very strong plants which have been kept growing vigorously and which are free from insects and fungus diseases, the use of early, perfect-flowered varieties, devoting an entire house to the crop, growing plants near the glass, hand-pollination in dull weather, liberal use of liquid manure after the berries have set, and keeping the fruit from wet surfaces.

Small fruit trials at the college, L. R. TAFT and H. P. GLADDEN (*Michigan Sta. Bul. 142, pp. 149–163*).—Tabular data are given comparing the vigor and productiveness of plants, the size, form, color, quality, and firmness of fruit, and the date of blooming and ripening of 126 varieties of strawberries. Descriptive notes are given on 29 varieties which fruited for the first time at the college in 1896, and on 20 new varieties of 1895. The yield of the perfect-flowering varieties was much smaller than of imperfect ones. The authors believe the difference to be due to the weakening effect of pollen production.

Similar tabular data are given on 23 varieties of black and hybrid raspberries and 17 varieties of red raspberries. Descriptive notes are given on 22 varieties of black and hybrid raspberries, 13 red raspberries, 3 blackberries, 1 dewberry, 18 grapes, and the Mayberry, Loganberry, wineberry, and strawberry-raspberry.

Wind-breaks, F. W. CARD (*Nebraska Sta. Bul. 48, pp. 69–96, figs. 3, pls. 2*).—The bulletin treats of wind-breaks in relation to fruit production, giving the results of experiments at the station and a summary of the views of fruit growers on the subject.

Circulars were sent to fruit growers throughout Nebraska and in other States, requesting their observations and opinions on matters relating to the effect of wind-breaks on fruit production. The replies indicate that, while there are some objections to the use of wind-breaks, their advantages entirely outweigh their disadvantages. The most prominent beneficial tendencies of wind-breaks on the western plains are to conserve moisture during the growing season by checking the evaporation from soil and plants, to protect plants from occasional hot winds, and to prevent the loss of fruit from windfalls. A beneficial effect of less importance in the West is the tendency to hold snow in place. A disadvantage of wind-breaks is the favorable conditions they sometimes afford to the development of plant diseases, especially apple blight in the West and grape diseases in the East. Wind-breaks may also in rare instances either prevent or induce frost. The protection wind-breaks give to insects and birds is sometimes detrimental and sometimes beneficial.

Observations at the station were made on the effect of wind-breaks in checking evaporation of moisture. The relative evaporation at different distances from wind-breaks was found indirectly by determining the percentage of water retained in the soil at those places. Determinations of the water content of the soil at various points north and south of osage orange hedges, which were about 5 ft. high and rather thin, gave no definite results. Determinations of soil moisture at intervals of 2 rods for a distance of 15 rods north of a belt of 15 rows of forest trees from 4 to 8 ft. apart and 20 to 30 ft. high showed a decrease in the percentage of water as the distance from the trees increased. This decrease was noticeable for about 10 rods, there being no marked variation beyond that. The results are illustrated by a diagram.

The evaporation of water as influenced by wind-breaks was observed directly by means of evaporometers, one being placed 3 rods north, one 12 rods north, and one 20 rods south of a belt of 22 rows of trees from 4 to 8 ft. apart and 25 to 40 ft. high. The evaporation was measured continuously from the middle of July to the middle of September. The effect of the wind-break in checking evaporation is shown graphically by means of diagrams. The relative quantities of water evaporated in the three positions named are given for the whole period, for the aggregate of periods when the wind was northerly, when it was southerly, and when it was easterly, westerly, and unrecorded, and for special periods when there was a strong south wind combined with low relative humidity. In the following table these data are brought together:

Relative evaporation at different positions with reference to a wind-break.

Position of evaporometer with reference to wind-break.	During whole period (two months).	During periods when wind was—			During special periods with strong south wind and low relative humidity.			
		Northerly.	Easterly, westerly, unrecorded.	Southerly.	August 3, 12 hrs.	August 24 and 25, 25 hrs.	August 27 and 28, 29 hrs.	September 7, 10 hrs.
20 rods south	100	100	100	100	100	100	100	100
12 rods north	91	112	91	83	67	82	83	72
3 rods north	71	101	78	55	29	37	38	47

Measurements of the height of millet in the field north of the wind-break above noted were made September 7. The results are given in a diagram. The author says: "The trees affected the millet injuriously for about 2 rods. For the next 3 rods it was very large. From 6 rods to 15 rods north of the wind-break there was a marked and uniform decrease in height."

Observations are also reported on the greater abundance of dew near the wind-break than at a distance from it.

Report of the horticulturist, S. M. EMERY (*Montana Sta. Bul. 12, pp. 73–93*).—General remarks are made on the work of the horticultural department of the station. Lists are given showing the number of trees of the different varieties of apples, crab apples, pears, cherries, plums, prunes, and apricots set out at the station in 1895 and 1896, the number now living, and the number dead.

Strawberry culture.—A description is given of experimental plats for strawberry culture. The objects sought to be accomplished by variety tests are noted. The results of a test of 58 varieties of strawberries are tabulated, showing date of blooming and ripening and yield of fruit. A table is also given comparing the yield of 19 varieties which averaged above one-half pound of fruit per plant. A brief note is given on the behavior of each variety tested.

Chrysanthemums in 1896, L. H. BAILEY and W. MILLER (*New York Cornell Sta. Bul. 136, pp. 300–320, figs. 7*).—General remarks are made upon the province of the station in testing varieties, exhibiting flowers, and the like. The station takes the position that the real measure of a variety is "the composite character which the whole patch gives under good care," rather than the peculiar character of a single bloom selected from a large number of plants given the utmost care and forcing. Some of the present tendencies and needs in the development of varieties are pointed out.

A few hints are given to home growers of chrysanthemums. Cultural and varietal notes are given on the tests of 1896. Among the introductions of 1896 the greatest advances in form were made in the whites. No true pink flowers have been obtained in chrysanthemums. The intensity of color in the so-called pinks is thought to be dependent upon little-understood conditions, including individual vigor of the stock, time of rooting the cuttings, kind and quantity of food supply, and shading. Descriptive notes are given on 24 varieties which seem to have special merit. Lists of varieties that proved unsatisfactory in the test are also given. A number of varieties are illustrated.

A talk about dahlias, W. MILLER (*New York Cornell Sta. Bul. 128, pp. 99–136, figs. 9*).—A brief history of the evolution of the dahlia is given, together with suggestions as to lines for future improvement. The author believes too much attention has been paid to color and not enough to form. The several hundred varieties produced in the first 80 or 90 years of dahlia culture were all color modifications of one type of flower. The form of the flower has been only recently modified, to present more freedom and grace. The author suggests that the dahlia should be developed along the same lines as the chrysanthemum has been, that the season of bloom should be lengthened, etc.

Methods of culture and propagation are considered. A test at the station in 1896 included 354 varieties. Brief notes are given on 40 of these, which are recommended on the basis of 1 year's behavior.

A second account of sweet peas, A. P. WYMAN and M. G. KAINS (*New York Cornell Sta. Bul. 127, pp. 63–95, figs. 2*).—The letter of transmittal by L. H. Bailey includes a graphic representation by W. T. Hutchins of the probable evolution of the modern varieties of sweet peas, remarks by W. C. Rohnert on his efforts to breed new varieties by crossing, and a note on 2 tests of forcing sweet peas.

The bulletin contains original descriptions of a large number of varieties of sweet peas grown at the station in 1896; a discussion of form, size, substance, and color of blossoms, and of classification of varieties; numerical notes in tabular form on the varieties tested, including season of blossoming, height of plant, length of stem, quantity of bloom, size, substance, and production of seed. Lists are given of the varieties which in the authors' opinion are most attractive.

Suggestions for chicory culture, T. L. LYON (*Nebraska Sta. Bul. 49, pp. 99-104*).—A popular bulletin giving directions for chicory growing. Soil, manuring, plowing, preparing the seed bed, planting, thinning, harvesting, and the like are discussed.

Garden crops, C. P. FOX (*Idaho Sta. Bul. 10, pp. 30-131, figs. 63*).—The following vegetables and herbs are considered: Asparagus, beans, cabbage, cauliflower, collards, kohl-rabi, sea kale, rape, cress, chicory, spinach, sorrel, dandelion, kale, mustard, lettuce, endive, celery, rhubarb, globe artichokes, Jerusalem artichokes, beets, carrots, horse-radish, parsnips, parsley, potatoes, radishes, salsify, turnips, okra, onions, leeks, peppers, sweet corn, cucumbers, watermelons, muskmelons, gourds, squash, pumpkins, tomatoes, eggplant, anise, caraway, coriander, and sage. Most of the above vegetables are described and illustrated. Directions for their culture and receipts for cooking them are given, and the varieties of each found best suited to Idaho are noted. In some cases tables are given comparing the yield of the different varieties tested.

The home vegetable garden, W. S. MASSEY (*North Carolina Sta. Rpt. 1896, pp. 279-325, figs. 2*).—A reprint from Bulletin 132 of the station (E. S. R., 9, p. 50).

How to grow mushrooms, W. FALCONER (*U. S. Dept. Agr., Farmers' Bul. 53, pp. 19, figs. 14*).—Popular directions for mushroom culture. The following points are considered: Places for growing mushrooms; preparation of beds; temperature; spawn; gathering, sorting, and packing the crop; insect enemies, diseases, etc.

Concerning truffles with reference to their occurrence in Switzerland, E. FISCHER (*Mitt. naturf. Gesell. Bern, 1896, pp. 8, 9*).

Concerning the Tuberaceæ and Gasteromycetes, E. FISCHER (*Mitt. naturf. Gesell. Bern, 1896, p. 12*).

Experiments with fertilizers on garden crops, C. A. GOESSMANN (*Massachusetts Hatch Sta. Rpt. 1896, pp. 195-201*).—A continuation of experiments previously reported (E. S. R., 8, p. 406) and reprinted in this report. Notes and tabular statements of the yield for 1896 are given.

Compilation of analyses of fruits and garden crops, H. D. HASKINS (*Massachusetts Hatch Sta. Rpt. 1896, pp. 242-248*).—The data compiled from Wolff's tables and from analyses made at the station are stated in parts per 1,000 with a calculation of the ratio between phosphoric acid (taken as 1), potash, and nitrogen.

Olive culture in Russia, P. V. MASALSKI (*Selsk. Khoz. Lyesor., 182 (1896), pp. 911-925*).—Olive plantations are scattered throughout Transcaucasia and Crimea. The climate of southeastern and southwestern Transcaucasia and southern Crimea is especially favorable to olive growing. The industry is not important, however, except in the Artvin district in Transcaucasia, and even there it is not highly developed.

Fruit growing in Canada, J. CRAIG (*Ottawa Naturalist, 11 (1897), No. 4, pp. 73-91*).—The evolution of fruits and fruit culture and some of the factors contributing to it are briefly discussed. The history and present status of fruit growing in each of the 7 fruit districts into which the author divides Canada are noted.

Old fruit trees and what to do with them, W. C. GRASBY (*Gard. and Field, 23, No. 2, pp. 26-28, figs. 7*).—The article discusses the rejuvenation of old fruit trees.

The blackberries of Saxony, O. GELERT (*Abhandl. bot. Vereins, Brandenburg, 38, pp. 106–113; abs. in Bot. Centbl., 70 (1897), No. 11–12, p. 375*).

Fertilizers and fruits, G. W. SHAW (*Pacific Rural Press, 54 (1897), No. 7, p. 101; Pacific Tree and Vine, 14 (1897), No. 17, p. 53*).

Horticultural experiments at Southern Pines, 1895 (*North Carolina Sta. Rpt. 1896, pp. 159–201, figs. 24*).—A reprint of Bulletin 129 of the station (E. S. R., 8, p. 693).

Report of the horticulturist, J. T. STINSON (*Arkansas Sta. Rpt. 1896, pp. 75–105*).—A reprint from Bulletin 43 of the station (E. S. R., 8, p. 889).

Hardy shrubs, C. J. DAWSON (*Florists' Exchange, 9 (1897), No. 34, p. 757*).—Paper read before the Society of American Florists.

Asperulas, VILMORIN-ANDRIEUX (*Belg. Hort. et Agr., 9 (1897), No. 16, pp. 209, 210, figs. 2*).—*Asperula odorata* and *A. azurea* are described, illustrated, and their ornamental qualities are pointed out.

The coryanthes (*Gard. Chron., 3. ser., 22 (1897), No. 551, pp. 30, 31, figs. 3*).—Remarks on insect pollination of *Coryanthes macrantha* and notes on other species of these orchids.

Eucalyptus, S. MOTTET (*Rev. Hort., 69 (1897), No. 16, pp. 370–374, figs. 6*).—Descriptions of 17 species and illustrations of 6 species.

Hardy lady slippers (*Gard. Illus., 19 (1897), No. 959, pp. 300–302, figs. 5*).—Notes on a number of species of orchids.

Hybrid cinerarias, R. I. LYNCH (*Garden, 52, No. 1339, p. 43, pl. 1, fig. 1*).

Indigenous roses of Sarthe, M. GENTIL (*Bul. Soc. Agr. Sci. Arts Sarthe, 2. ser., 28 (1897), No. 1, pp. 15–119*).

Rose talk (*Florida Agr., 24, No. 30, p. 471*).—Popular article on culture and varieties of the rose.

Sweet-pea novelties of 1897, S. A. HAMILTON (*Florists' Exchange, 9 (1897), No. 30, pp. 677, 678, fig. 1; Amer. Gard., 18 (1897), No. 136, pp. 534, 535*).—Notes on 43 varieties.

The early history of sweet peas, S. B. DICKS (*Florists' Exchange, 9 (1897), No. 29, pp. 659–661, figs. 5*).

Starworts, W. DOD (*Gard. Illus., 19 (1897), No. 957, pp. 269, 270, fig. 1*).

Progress in Streptocarpus (*Jour. Hort., 49 (1897), No. 2550, pp. 141, 142, fig. 1*).—An account of the history of the improvement of Streptocarpus.

Tillandsia grandis, E. ANDRÉ (*Rev. Hort., 69 (1897), No. 15, pp. 345, 346, fig. 1*).

Vandas (*Gard. Illus., 19 (1897), No. 957, pp. 277, 278, fig. 1*).—Descriptive notes on several species of these orchids.

DISEASES OF PLANTS.

Two destructive celery blights, B. M. DUGGAR (*New York Cornell Sta. Bul. 132, pp. 201–220, figs. 13*).—The bulletin gives a general summary of the knowledge of these diseases and a special discussion of storage cellars and the prevalence of disease in them. Early celery blight, *Cercospora apii*, and late celery blight, *Septoria petroselini apii*, are described and illustrated, and the extent of the injuries caused by them is noted. Artificial cultures of the fungi were made on agar and sterilized bean stems. The cultures indicate that the fungi are not pleomorphic forms of the same species, as has been suggested.

In the experience of the author hot weather tends to increase the prevalence of the early blight, but moisture does not necessarily check it, as is held by some writers. A summary is given of the results of experiments by other workers on the value of various fungicides. An experiment was made at the station with ammoniacal copper carbonate solution and sulphur on badly diseased plants. The applications were made in the latter part of July. August 15 the rows dusted with sulphur were somewhat improved and those sprayed with the copper compound showed marked improvement. A second application was made but a heavy rain prevented any results being obtained.

The late blight, unlike the early, does not disappear with cool weather, but continues in the field until the plants are lifted and then extends its injuries to the storage cellar. The author gives the results of observations made by himself on the blight in storage houses in several localities. The disease at first affects the plants as in severe cases in the field; the outer green leaves wilt and soon the fungus spreads to the younger blanched leaves, wilting and discoloring them. No fungicides were tried, but from the nature of the disease and the conditions affecting its development the author recommends certain remedies. The plants in the field should be sprayed regularly to prevent the appearance of the disease. The badly affected leaves should be removed and the leafy portions of the plant might be dipped in a weak solution of ammoniacal copper carbonate before storing the crop. As preventive measures, the storage cellar should be kept but little above freezing temperature, free from excessive moisture, and given good ventilation.

Remarks are made upon the construction of storage houses with reference to checking the disease. A bibliography of the celery blights is appended.

A disease of currant canes, E. J. DURAND (*New York Cornell Sta. Bul. 125, pp. 23–38, figs. 16*).—The bulletin treats of the general and botanical characteristics of the disease and of its remedies. The disease is reported to manifest itself in a wilting of the leaves, which turn yellow and fall off, and a premature coloration of the fruits, which shrivel and fall away with the leaves. The denuded canes then die rapidly. Cuttings from apparently healthy canes on a diseased plant made an unusually slow growth. The author gives the history of the fungus *Tubercularia vulgaris* and its occurrence as a parasite, and describes his study of it and the results obtained. Cultures were made of *Tubercularia vulgaris*, *Nectria cinnabarina*, and *Pleonectria berolinensis*, 3 distinct fungi found on diseased canes. The mycelium of *Tubercularia vulgaris* spreads abundantly through the currant stem and is destructive to the plant. *Nectria cinnabarina* is known to be connected with *Tubercularia vulgaris*, but experiments by the author seem to prove that *Pleonectria berolinensis* is not in any way connected with *Tubercularia vulgaris*.

"The only positive remedy that can be suggested is the removal of the whole plant as soon as the disease begins to be manifested in the yellow foliage and prematurely colored fruits. The diseased plants should be burned, as the spores and conidia may be produced in abundance on dead plants and the trouble communicated to living bushes."

Scab of potatoes, W. P. BROOKS (*Massachusetts Hatch Sta. Rpt. 1896, pp. 44, 45*).—The author conducted a series of experiments to test the value of sulphur for the prevention of potato scab. One-half the seed required for the planting of a plat was treated with corrosive sublimate solution in the usual way. Then 240 hills of treated and untreated seed were planted. In the furrows of half of these sulphur at the rate of 300 lbs. per acre was scattered at the time of planting. The yields from the different lots of treated and untreated seed are tabulated, and the author draws from the figures given the conclusion that "the use of sulphur in the drill appears to have been absolutely without effect. The table indicates that even when seed is planted in infected land the treatment with corrosive sublimate is somewhat beneficial."

Report of the horticulturist, S. T. MAYNARD (*Massachusetts Hatch Sta. Rpt. 1896, pp. 53–56*).—A brief report is given on the use of insecticides and fungicides. The most common insecticides used were Paris green, kerosene emulsion, hellebore, and pyrethrum. In the greenhouses lemon oil was used very satisfactorily in keeping down scale insects and mealy bugs. The fungicides used were copper sulphate solutions, Bordeaux mixture, and ammoniacal copper carbonate.

A report is made upon dry Bordeaux mixture, many samples of which were carefully tested, and, so far as can be determined from one season's trial, the author thinks the results have not been satisfactory on account of the fact that (1) the material was not in a sufficiently fine condition; (2) it was impossible for it to adhere for any length of time to the foliage, even when applied to a wet surface, and (3) there was a great waste of material.

A steam spraying outfit is briefly described and recommended where sufficient work could be found for such an equipment. It is suggested that a steam engine suitable for this work could be fitted with a fly wheel, and could be used when not needed for spraying for cutting wood, corn fodder or silage, grinding grain, etc.

A brief preliminary report is given on 367 different lots of vegetable seed which were tested during the past year. With a few exceptions the vitality of the seed was found to be satisfactory. A complete report of the work of the season's testing will be presented later.

Fungiroid, W. P. BROOKS (*Massachusetts Hatch Sta. Rpt. 1896, pp. 43, 44*).—A report is given upon the use of fungiroid alone and in combination with Paris green for the prevention of potato blight. The fungiroid and Paris green mixture was applied at the rate of 2 lbs. per acre on July 13, 18, 22, and 24, and pure fungiroid at the rate of 1½ lbs. per acre August 1 and 3. The season was hot, and frequent showers were favorable to the development of parasitic fungi. The fungicides were always applied after a heavy rain while the vines were still moist. By the date of the last application the blight was evident to a considerable extent in nearly every plat. When harvested the 38 treated rows yielded 7,887½ lbs. of large and 983 lbs. of small potatoes, while the 38 rows which were untreated produced 8,407 lbs. of large and 960 lbs. of small potatoes. The author thinks the results indicated no favorable influence due to the use of this fungicide.

The diseases of plants, W. G. SMITH (*Gar . Chron., 3. ser., 22 (1897), Nos. 553, p. 61; 555, pp. 97, 98; 556, pp. 117, 118; 557, p. 140; 558, pp. 156, 157*).—A series of popular papers giving the present status of our information relative to many diseases and their prevention.

Concerning the spread of plant diseases, K. VON TUBEUF (*Forstl. naturw. Ztschr., 6 (1897), No. 8, pp. 320–325, figs. 3*).

Parasitic fungi of Cherson, B. ISSATSCHENKO (*St. Petersburg, 1896, pp. 26; abs. in Bot. Centbl., 71 (1897), No. 7, pp. 233–235*).

Parasitic fungi and the means for their prevention, P. NIJPELS (*Bibliothéque nat. agr. Liege, 1896; abs. in Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 13–14, pp. 375, 376*).

Some parasitic Brazilian fungi, P. A. SACCARDO (*Bul. Soc. Roy. Bot. Belgique, 35 (1896), pp. 127–132, pl. 1*).—Describes 8 new species of parasitic fungi on orchid leaves.

Attacks of parasitic fungi on forest trees during 1893–'95, E. ROSTRUP (*Tidsskr. Skovväsen, 8 (1896), p. 16; abs. in Bot. Centbl., 71 (1897), No. 7, pp. 246–250*).—Gives an account of fungus attacks in the forests of Denmark.

Variation in fungi due to the substratum in which they are grown, J. RAY (*Rev. Gén. Bot., 9 (1897), Nos. 102, pp. 193–212; 103, pp. 245–259; 104, pp. 282–304, pls. 6*).—Notes are given on the variations observed in Sterigmatocystis, Aspergillus, and Penicillium when grown in different media.

Notes on entomogenous fungi, G. LINDAU (*Naturw. Wochenschr., 12 (1897), No. 26, pp. 304–307*).

New investigations on the rust fungi, E. FISCHER (*Mitt. naturf. Gesell. Bern, 1896, p. 9*).

Contributions to the knowledge of Swiss rust fungi, E. FISCHER (*Bul. Herb. Boissier, 5 (1897), No. 5, pp. 393–397*).

Notes on some Australian entomogenous fungi and description of a South Australian variety of Cordyceps gunnii, J. G. O. TEPPER (*Bot. Centbl., 70 (1897), No. 10, pp. 305–307*).

Notes on the fungus diseases of Setaria italica, M. SHIRAI (*Bot. Mag. Tokyo, 9 (1897), No. 122, pp. 25–29*).

Asparagus rust, B. D. HALSTED (*Gard. and Forest, 10 (1897), No. 486, p. 236*).—The fungus *Puccinia asparagi* is popularly described and preventive measures suggested.

A renewed outbreak of the asparagus rust, B. D. HALSTED (*Gard. and Forest, 10 (1897), No. 496, p. 335, fig. 1*).

Field experiments with beets affected with gummosis, P. SORAUER (*Ztschr. Pflanzenkrank., 7 (1897), No. 2, pp. 77–80*).

Additional notes on the Monilia epidemic of cherry trees, FRANK and KRÜGER (*Gartenflora, 46 (1897), No. 15, pp. 393–396*).

Monilia epidemic of cherry trees (*Ztschr. landw. Ver. Hessen, 1897, No. 31, pp. 278, 279*).

The sooty mold of citrus trees, D. MCALPINE (*Proc. Linn. Soc. New South Wales, 21 (1896), IV, pp. 469–498, pls. 12*).—The author concludes this disease is due to a new polymorphous fungus to which the name *Capnodium citricolum* is given.

Dodder in clover, B. D. HALSTED (*Gard. and Forest, 10 (1897), No. 490, p. 280*).

A bacterial disease of grapes, BARBUT (*La Vigne Française, 1896, No. 13, p. 207; abs. in Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 11–12, pp. 328, 329*).

On the perpetuation and dissemination of black rot by tendrils (*Rev. Vit., 1897, No. 162, pp. 103, 104*).

A new disease of hemp, V. PEGLION (*Ztschr. Pflanzenkrank., 7 (1897), No. 2, pp. 81–84*).—A bacterial disease due to *Bacillus cubonianus* is described.

A lily disease, W. WATSON (*Gard. and Forest, 10 (1897), No. 500, p. 371*).—Notes the occurrence of a disease of Japanese and Bermuda lilies due to *Rhizopus necans.*

The Bermuda lily disease (*Gard. and Forest, 10 (1897), No. 492, p. 297*).—Notes are given of investigations conducted by A. F. Woods, of this Department, as to the cause and remedies for this disease.

A disease of mulberries, PRILLIEUX and DELACROIX (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 21, pp. 1168–1170*).—Notes are given on a disease of mulberries in Turkey, which is said to be due to *Sclerotinia libertiana.* This fungus is known to be parasitic on beans, peas, and artichokes.

On the similarity of mulberry dwarfs and peach yellows in regard to their symptoms and causes, N. ICHIKAWA (*Bot. Mag. Tokyo, 9 (1896) pp. 82–89*).

A disease of orchids, MAGNIN (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 19, pp. 1038–1040*).—Notes are given of a disease of Cattleya and Lælia due to *Glœosporium macropus.* Bordeaux mixture, to which 4 gm. naphthol β is added, is recommended for preventive treatment.

The diseases of fruit trees, C. BACH (*Wochenbl. landw. Ver. Baden, 1897, p. 84*).

Pear blight, J. T. STINSON (*Arkansas Sta. Rpt. 1896, pp. 117–120*).—A reprint from Bulletin 43 of the station (E. S. R., 8, p. 899).

On the occurrence of leaf spot of potatoes in 1896, F. WAGNER (*Ztschr. Pflanzenkrank., 7 (1897), No. 3, pp. 130, 131*).—Notes on an outbreak of leaf spot of potatoes due to *Macrosporium solani.*

Notes on potato rot (*Braunschw. landw. Ztg., 65 (1897), No. 35, p. 152*).

Blistered peach trees (*Gard. Chron., 3. ser., 21 (1897), No. 546, p. 388*).—Notes are given of a disease of peach trees that results in a swollen, blistered appearance.

A bacteriological study of the gummosis of the sugar beet, W. BUSSE (*Ztschr. Pflanzenkrank., 7 (1897), Nos. 2, pp. 65–77; 3, pp. 149–155*).—Notes are given of *Bacillus betæ*, different forms of which are recognized and described.

Experiments in 1896 for the prevention of wet and dry rot of sugar beets, FRANK (*Ztschr. Ver. Rübenz. Ind., 47 (1896), pp. 901–928*).

Recent investigations on the leaf spot of sugar beets, FRANK (*Ztschr. Ver. Rübenz. Ind., 47 (1896), pp. 589–597, pl. 1*).—Notes are given of *Cercospora beticola.*

The diseases of sugar cane, C. A. BARBER (*Science Progress, n. ser., 1 (1897), No. 4, pp. 460–482*).

A tomato disease (*Gard. Chron., 3. ser., 22 (1897), No. 549, p. 8*).—Notes are given of a rotting of tomatoes, which is said to be due to bacteria.

A sclerotium disease of tulip bulbs, F. LUDWIG (*Deut. bot. Monatsschr., 15 (1897), No. 5, pp. 153, 154*).

Characteristics of the brown rust of wheat, J. ERIKSSON (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 9–10, pp. 245–251, fig. 1*).—Notes are given and a report made on experiments with *Puccinia dispersa.*

A chrysanthemum disease, B. T. GALLOWAY (*Gard. and Forest, 10 (1897), No. 492, p. 293, fig. 1*).—Notes are given of a diseased condition of chrysanthemums that is, so far as known, confined to the variety known as the Philadelphia.

On the destruction of beechnuts during the winter by Mucor mucedo, R. HARTIG (*Forstl. naturw. Ztschr., 6 (1897), No. 9, pp. 337–339*).

Some observations on the Uredineæ, E. FISCHER (*Arch. Sci. Phys. et Nat., 1896, pp. 182–185*).

On the morphology of the Blastomyces, O. CASSAGRANDI (*Naturalista Siciliano, n. ser., 2 (1897), No. 1–3, pp. 1–24*).

Notes on the Hymenomycetes, M. BRITZELMAYR (*Bot. Centbl., 71 (1897), Nos. 2, pp. 49–59; 3, pp. 87–96*).

A contribution to the knowledge of the Peronosporeæ, Ustilagineæ, and Uredineæ of Bohemia, F. BUBÁK (*Verhandl. zool. bot. Gesell. Wien, 1897, p. 9*).

Notes on the growth of Phycomyces nitens, G. BULLOT (*Ann. Soc. Belge Micros., 21 (1897), pp. 69–91, pl. 1*).

Concerning the origin of the Saccharomycetes, A. KLÖCKER and H. SCHIÖNNING (*Alkohol, 7 (1897), No. 31, pp. 487, 488*).

Notes on Exobasidium and Exoascus, F. THOMAS (*Forstl. naturw. Ztschr., 6 (1897), No. 8, pp. 305–314, figs. 3*).

Exobasidium vitis, V. PEGLION (*Atti R. Accad. Lincei, 5. ser., 6 (1897), No. 1, pp. 35–39*).

Recent investigations concerning the nature and occurrence of the crown rusts, J. ERIKSSON (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 11–12, pp. 291–308*).—Notes are given of *Puccinia coronata* and *P. coronifera*.

Concerning the simultaneous appearance of Uromyces betæ and Phoma betæ, M. N. BERGER (*Bul. Assoc. Belge Chim., 10 (1896), p. 336; abs. in Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 13–14, pp. 377, 378*).

The sycamore blight, B. D. HALSTED (*Gard. and Forest, 10 (1897), No. 488, pp. 257, 258*).

Additional notes on the existence of Pseudocommis vitis, E. ROZE (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 20, pp. 109–111*).

Aster sickness and its cause, H. FRIEND (*Gard. Chron., 3. ser., 22 (1897), No. 555, p. 97*).—Notes are given of a disease of asters due to *Enchytræus parvulus*.

On a new pest of Pirus communis, G. DEL GUERCIO (*Nuova Gior. Bot. Ital., 4 (1897), No. 4, pp. 433–438, figs. 3*).—Notes are given of injury done to *Pirus communis* by *Hormomyia bergenstammi*.

Sun scald and means for its prevention, E. S. GOFF (*Gard. and Forest, 10 (1897), No. 500, p. 371*).—Describes sun scald of trees and recommends some kind of shade or nonconducting substance as a protection.

Arsenate of lead with Bordeaux mixture, J. CRAIG (*Gard. and Forest, 10 (1897), No. 496, p. 336*).—Reports injury to foliage of crab trees when these two substances were combined.

On the action of guaiacol on the spores of Aspergillus fumigatus, BOULANGER-DAUSSE (*Jour. Pharm. et Med., 1897, No. 7*).

Means for combating the vegetable and animal parasites of the sugar beet, H. BRIEM (*Agr. Rationelle, 1897, No. 8*).

Corrosive sublimate for potato scab (*Montana Sta. Bul. 12, p. 104*).—Brief notes on the use of corrosive sublimate for the prevention of potato scab.

A new remedy for grape mildew and black rot, G. LAVERGNE (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 26, pp. 1542, 1543*).—Copper sulphate, 500 gm., black or green soap, 1,000 gm., and water, 100 liters, is recommended as a fungicide for the prevention of these diseases.

Combating black rot of grapes, GUIAUD (*Monit. Vinicole, 1896, No. 30, p. 118; abs. in Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 11–12, pp. 332, 333*).—Sublimated sulphur is considered a valuable fungicide for use against black rot.

Treatment for smut in wheat, barley, and oats (*Montana Sta. Bul. 12, pp. 105, 106*).—Notes on the use of copper sulphate for the prevention of smut in these cereals.

On the prevention of smuts, especially of oats and barley, by the treatment of the seed grain, M. HOLLRUNG (*Landw. Jahrb., 26 (1897), No. 1, pp. 145–190*).

Spraying fruits; strawberries; grapes, J. T. STINSON (*Arkansas Sta. Rpt. 1896, pp. 17–34, figs. 2*).—A reprint of Bulletin 39 of the station (E. S. R., 8, p. 133).

ENTOMOLOGY.

The currant stem girdler and the raspberry cane maggot, M. V. SLINGERLAND (*New York Cornell Sta. Bul. 126, pp. 41–60, pls. 3, figs. 6*).—The author gives a popular description of the currant stem girdler, *Janus integer*;[1] discusses briefly its history, distribution, and destructiveness, and shows how the insect makes its presence known. Its life history is fully discussed. The girdling process is described as follows:

"She first forces her ovipositor its whole length into the shoot. When she withdraws it, however, she does not pull it straight out, but twists it to one side, so that it is held at right angles to the body, and then makes it saw its way out. As the ovipositor is curved, its tip first appears through the bark of the shoot off at one side from where it was forced in, and the rest of the 'saw' soon comes through, leaving a smooth, somewhat curved cut, forming a part of the circle around the shoot equal in length to about the length of the ovipositor. Without moving from her position, the female usually again inserts her ovipositor very near where she did the first time, but twists it the other way, thus making 2 cuts extending in opposite directions from one point. She then moves around the shoot until she finds the end of one cut and proceeds in the same manner to cut another slit. She continues this process of moving around the stem and cutting new slits from the ends of those just made until the girdle of cuts is complete, or nearly so. We have repeatedly seen a female lay an egg in a minute and in the next 4 minutes girdle the shoot a short distance above the egg. Sometimes the girdling is so complete that the tip falls off at once, but usually a portion of the shoot remains uncut, and the tip may remain attached for some time, especially if the shoot is a large and vigorous one. . . . In some cases the female lost her bearings to such an extent as to continue the girdle of cuts in a spiral direction, so that the last cut was above and nearly an eighth of an inch from the first one. Sometimes the female did not first make 2 cuts from the same point, but at once moved around the stem and made the second cut at the end of the first, and so on around. Usually 4 or 5 cuts were sufficient to girdle a shoot."

The process was watched in a breeding cage in which an attempt had been made to imitate as nearly as possible the native "heath" of the insect. The female began laying within 15 minutes after being introduced into the cage.

Great mortality among the eggs and young grubs is noted. Not over 15 per cent of the eggs laid, as shown by material sent to the station in 1896, developed full-grown borers. In many cases eggs did not hatch. This latter fact the author endeavors to explain by supposing that the unfertilized female will lay eggs and girdle shoots as readily as a fertilized one.

The habits of the borers, the extent of their tunnels, and their preparations for winter are discussed. *Bracon apicatus* is noted as the chief natural enemy. Applying the facts of the life history of the insect, the author advises as a remedy the cutting off and burning of the affected shoots—about 3 in. from the tip, if done in May or June, soon after the girdling is done; or about 8 in. from the tip if done later in the year.

The raspberry cane maggot is referred to the genus Phorbia, but is not specifically identified. The author first learned of the ravages of the insect in New York in May, 1895, when he received specimens from localities in central New York. The insect begins its work as soon as the shoots appear above ground in the latter part of April and contin-

[1] Syn. *Cephus integer*, *C. filicornis*, *J. flaviventris*, and *Phyllœcus flaviventris*.

ues during the month of May. The indications of its presence are noted as follows:

"This raspberry cane maggot attacks only the new shoots which appear in the spring. The results of its work are very conspicuous, and raspberry growers can thus easily determine if the insect is present in their fields. The tips of new shoots attacked by the insect wilt and droop; the stem of the tip shrinks, turns dark blue in color, and finally dies The wilted tip may be easily broken off at a certain point. If the shoot be carefully examined at this point it will be found to have been girdled by the insect from the inside; how this girdling is done will be described in telling the life history of this pest. Sometimes a very vigorous shoot will continue its growth from side buds, thus forming a branched cane, but usually the injury to the tip results in the death of the whole shoot. In one case the terminal tip and the tips of 3 of its side shoots had all been killed by the insect."

The appearance of the insect is described, its name, history, distribution, food plants, and life history discussed. The hymenopterous parasite, *Indiasta incompleta*, is noted as a natural enemy. The remedy recommended is the cutting off and destruction of the tip of the plant infected by the insect.

The army worm in New York, M. V. SLINGERLAND (*New York Cornell Sta. Bul. 133, pp. 233–258, figs. 6*).—It is stated that the most serious outbreak of *Leucania unipuncta* known in the history of New York occurred during 1896. Reports were received of severe injuries in 48 of the 60 counties of the State. In nearly every case it was the July brood that did the damage. The insect is described, its history in North America briefly brought out, the manner in which the larvæ indicate their presence noted, as well as what they eat, and their capacity for injury. Its life history is discussed at some length and summarized briefly as follows:

"The moths which may hibernate oviposit early and the caterpillars which hatch from these eggs, augmented by the somewhat larger ones which were born late the preceding fall and hibernated, form a May brood of worms that may possibly be numerous enough some years to necessitate their marching to new feeding grounds. The caterpillars of this first brood undergo their transformations through the pupa stage to the adult insect or moth early in June, and the progeny of these moths form a second and often injurious marching brood of the worms in the early part of July. A third brood of the worms, which are rarely injurious, is developed in September, and the moths into which these transform may lay eggs from which will hatch the young caterpillars that hibernate or some of the moths themselves may hibernate and oviposit in the spring."

Inasmuch as the appearance of a large number of the insect foes occurs periodically, it is thought that no fear need be entertained of this pest for some years to come. Concerning the uses that may be made of infested fields, it is advised that infested crops of oats and other grains be cut down and made into hay or put into the silo, and that millet, Hungarian grass, or turnips be sowed upon infested fields after these are well plowed, harrowed, rolled, and fertilized. Under the head of natural enemies note is made of the red tail tachina fly (*Winthemia 4-postulata*). The customary remedial measures of furrows and pits are noted.

The pine geometer moth (Fidonia piniaria), R. S. MacDougall (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 9 (1896), pp. 106–123, figs. 3*).—This is an account of a study of the ravages in the Bavarian forests near Nuremberg in 1895, of the pine looper or pine geometer moth, whose caterpillars defoliated the trees, caused their death, and necessitated the felling of millions of Scotch pine. The characteristics of the Geometridæ and of this particular species are described; and its distribution, food plants, and habits considered, as well as the remedial measures. The moths are reported as frequenting plantations of very young trees, and as laying from 58 to 66 eggs in a row on the inner side of the pine needle in June. The eggs hatch in from a fortnight to 3 weeks. The young caterpillars gnaw the surface of the leaf here and there, but the older ones attack the needles at the edges, generally near the apex, and work downward, leaving patches here and there and the midrib uninjured. The larvæ finally make their way to the ground and pupate in the moss or litter of fallen needles, often in numbers as great as 313 to 774 per square yard.

Defense against the pest, once it has begun its work, is difficult. The eggs being laid high, burning the branches might have some effect; the attraction of the moths by electric lights is helpful, as also the use of sticky bands about the trunk of the tree for the larvæ which may chance to fall and try to reascend. The method of shaking caterpillars from the trees is valueless, since the larvæ cling tightly to the leaves, and also since it is somewhat injurious to small trees. The best plan is to attack the pupæ, and this may be done by leading swine to the infested areas and supplementing their rooting by collecting. The larvæ may be raked out of the forest and burned, but this will not destroy all the pupæ, for from an extended series of countings it has been estimated that 35 per cent of the pupæ are to be found in the moss and fallen needles, 60 per cent in the humus, and 5 per cent in the mineral layer of the soil. Further, the author points out that considerable help is received from nature in the form of weather influences, insectivorous animals, birds, and insects, as well as the fact that mixed forests tend to discourage attacks. In addition, the author considers briefly the predisposition of the weakened pines to attack from injurious beetles, the chances of recovery after defoliation, under which head he points out that, inasmuch as the insect is a late feeder, a moderate destruction of needles is not fraught with very serious results, but that when taken into consideration with other unfavorable circumstances thousands of trees may be killed, as in the case of Nuremberg forests in 1895.

Finally, there are considered the lessons of the devastation at Nuremberg, under which head he points out that remedial measures must be started in the beginning of a plague, and that for the carrying out of this principle a knowledge of insects and of their habits is absolutely necessary.

The pistol case bearer in western New York, M. V. SLINGERLAND (*New York Cornell Sta. Bul. 124, p. 17, figs. 2, pls. 2*).—In this popular bulletin it is stated that during 1896 *Coleophora malivorella* appeared in large numbers in various apple orchards of western New York, and proved to be a much greater pest than the cigar case bearer (*Coleophora fletcherella*). It was not infrequently found feeding on the same branch with the latter and with the bud moth (*Tmetocera ocellana*). The author briefly reviews the history of the pest and describes its appearance and life history. In a footnote, a description of the larvæ differing from that by C. V. Riley[1] is given as follows:

"Length, 6 mm. Color, deep chrome or light orange; the thoracic segments are darker, the first one blackish. Head, black, with a yellow median suture; antennæ, yellow. Thoracic segments each with a blackish, granulate, chitinous spot on the lateral ridge; the mesothoracic segment has besides 2 similar, narrow, triangular, black, transverse spots, separated by a narrow yellow mesal line near its caudal border, and there is a similar subdorsal black spot on each side near the cephalic margin; the thoracic shield is large, black, and nearly divided by a narrow yellow median stripe. The anal shield is also black. The true legs are black, with the distal segment and the extremities of the other segments yellowish. The 4 pairs of pro-legs are of the same color as the body, except the anal ones, which are slightly darker and have a large black spot near the base of each. The whole surface of the body is granulated, more strongly so on the thoracic and anal segments. A few hairs arise from the head, thorax, and anal segment."

In the description of the adult, it is noted that both sexes are provided with a tuft of large scales on the dorsal antennal joint. This differs from C. V. Riley's[1] description, which stated that the male is without such tufts. Summarizing briefly the result of his studies of the insect's life history in New York, the author says:

"The insect spends about 7 months (from September 1 to April 1) of its life in hibernation as a minute, half-grown caterpillar in a small pistol-shaped case attached to a twig. In the spring the caterpillars attack the swelling buds, the expanding leaves, and especially the flowers. About May 1 the cases are fastened to the twigs, where they remain for 4 days, during which time the caterpillars shed their skin or molt. They do not make any complete new suit as they grow, but are content with making additions to the ends and side of the old suit. They are not miners, but feed openly, eating irregular holes in the leaves, often skeletonizing them. They are most destructive on the flowers, where they eat the petals and stems. In the latter part of May they cease feeding, securely fasten the cases to the branches, and in about 2 weeks change to pupæ within. The moth emerges in 2 or 3 weeks, and soon glues its minute, pretty, cinnamon-colored, inverted cup-like eggs to the surfaces of the leaves. The egg stage lasts about a week, the little caterpillars emerging about July 22. They begin eating little holes in the leaves, and during their first meal construct of silk and excrement a small case or suit for themselves. They continue feeding on the leaves, adding to their suits from time to time, until about September 1, when they begin to migrate to the twigs and there fasten their little pistol-shaped cases to the bark. The winter is passed in these snug, warm, secure quarters."

No natural enemies of the insect were met with by the author, though he notes that there is recorded a minute chalcid as parasitic upon it.

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[1] Ann. Rpt. Comr. Agr. 1878, p. 254.

It is thought impossible to successfully attack the insect except in the larval stage. No experiments against the insect were made by the author, but experiments made by his correspondents with Bordeaux mixture, London purple, and kerosene emulsion in connection with his study of the life history and habits of the pest inclined him to think that it may be held in check by thorough spraying with Paris green used at the rate of 1 lb. to 105 to 200 gals. water.

The spruce gall louse, C. H. FERNALD (*Massachusetts Agr. Col. Rpt. 1896, pp. 89–99, pls. 2*).—The spruce gall louse, spruce adelges, or spruce chermes (*Chermes abietis*), its life history, habits, distribution, destructiveness, and enemies are here considered. The remedies against it are briefly noted.

Though found in the United States from the Atlantic to the Pacific, it is thought to have been imported with Norway spruces. Following through its life history and examining a large number of specimens resulted in finding no males. Hence it is concluded, along with Cholodowski, that the species is purely parthenogenetic.

The formation of the gall is briefly explained, and the mere piercing of the setæ without the action of a poison said to be sufficient cause.

Some insects injurious to stored grain, F. H. CHITTENDEN (*U. S. Dept. Agr., Farmers' Bul. 45, pp. 24, figs. 18*).—This is an adaptation of "The more important insects injurious to stored grain" that appeared in the Yearbook of this Department for 1894 (E. S. R., 7, p. 515) and of chapter 8 of the bulletin on household insects (E. S. R., 9, p. 62). In addition to the insects treated in the places mentioned, the small-eyed flour beetle (*Polorus ratzeburgi*) and the foreign grain beetle (*Cathartus advena*) are treated. With reference to the latter it is noted that the beetle has been noted as injuring corn in the shock, dried parsley, stored wheat, and flour. The author has found it living in edible tubers, dates, figs, table beans, cacoa beans, rice, and middlings, and says that during the year it has been taken in a feed store at Washington, D. C. In experiments recently performed the beetle did not develop in fresh grain or meal, but in corn meal sufficiently moist to produce mold it bred freely. Feeding upon mold appears to be the normal habit of the insect, and hence the author concludes that this species, although it may injure grain to a certain extent, need not be greatly feared if the grain be stored in a dry, clean, and well-ventilated place.

With regard to the extent of the damage caused by granary insects, the author estimates that in the 8 Southern States, viz, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, and Arkansas, there is a total annual loss of $20,000,000. This estimate concerns corn and does not take into consideration wheat or other grain and mill products.

Parasitic and natural enemies, methods of control, and preventive remedies are discussed. As regards remedies, bisulphid of carbon is highly recommended. Coördinate with it are mentioned (1) thrashing as promptly as possible to prevent the Angoumois grain moth, rice weevil, and other species from being carried into the granary; (2) the thorough inspection, quarantining, and disinfection of grain bins and machinery before the grain is stored; (3) the destruction of refuse matter and the observance of scrupulous cleanliness; (4) either refitting old warehouses and mills, especially in warm latitudes, or constructing new ones designed to exclude insects; (5) the use of metal in the place of wood in the spouts, etc., in mills to exclude the flour moth; (6) the storage of grain in large bulk; (7) storage in well-ventilated and cool places to prevent heating; (8) the use of napthalene, especially in the case of small samples inclosed in tight receptacles.

Notes on scale insects, T. D. A. COCKRELL (*California Fruit Grower, 21 (1897), No. 1, p. 5*).—The author notes a new scale insect which he designates as *Lecanium magnoliarum* as having been imported from Japan and as found on young trees of a deciduous magnolia in the Japanese nursery at San José. The scale belongs to the subgenus Eulecanium and may be distinguished by its large size and elongate form. It is 8 mm. long, 4½ mm. wide, and 2½ mm. high; of an elongate, oval shape, and of a dark-brown color. The subdorsal area is irregular, mottled with black, or blackish. The surface is granular; the legs are very slender; the antennæ 8-jointed, with a formula varying from 3 (451) (28) 67 to 3 (41) 52 (86) 7.

The author says that by no means should the insect be allowed to spread, as it is very likely that it may infest other plants than the magnolia, and even if it does not it will become troublesome in gardens.

On a new Myxosporidium of the family of Glugeideæ, L. LEGER (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 4, pp. 260–262*).—On the larvæ of *Simulium ornatum* the author found a Myxosporidium, which he describes as *Glugea varians.* The abdominal region of the affected larvæ is dilated and of a milky-white color, contrasting strongly with the somber tint of the normal individual. Dissection and the use of a lens showed the body cavity of the larvæ to be filled with masses of parasites free and forming whitish sacs with irregular contours. In some badly affected larvæ the excessive growth of the parasitic sacs produces hernia on the abdominal surface. A microscopic examination of the sacs shows them to be thin, transparent, and filled with spores. These are ovoid, refracting bodies, with a vacuole at the larger end. Treated with iodin they show a filament, 15 to 20 times longer than themselves, that arises from the pointed end. The spores are of 2 sizes, one from 4 to 5μ, the other about 8μ in diameter. Some of the sacs contain only microspores. These are united in groups of 8 or inclosed in a frail skin. The macrospores are gathered into masses of different sizes and each inclosed in a thin envelope. The octo-spored cysts recall *Telohania contejeani* of Henneguy, which is parasitic in the muscles of the crayfish.

Swarming box for bees, A. H. HUFF (*Amer. Agr. (middle ed.), 59 (1897), No. 21, p. 637*).—An ordinary 10 to 12 in. square box at the end of a pole containing a little honey as bait. Small holes bored in it allow circulation of air. When a swarm settles, the box is pushed up over the cluster.

Notes on honey, A. GALE (*Agr. Gaz. New South Wales, 8 (1897), No. 2, pp. 111–112*).

Some facts about wasps and bees, R. W. SHUFELDT (*Appleton's Pop. Sci. Monthly, 51 (1897), No. 3, pp. 315–324, figs. 2*).—Among other things, it is noted that a man stung by a large wasp on a Mississippi River boat died from the effects. The wasp had been knocked down on the boat and found to be carrying a large cicada.

List of the Neuroptera collected by E. E. Austen on the Amazon, etc., W. F. KIRBY (*Ann. Mag. Nat. Hist., 6. ser., 19 (1897), No. 114, pp. 598–618, pls. 2*).—Descriptions of new species of Odonata, viz, *Miathyria flavescens, Perithemis austeni, Uracis siemensi, Micrathyria eximia, M. tibialis, M. basalis, M. venusta*, and *Campsurus pictcti*.

The golden eye or lace wing fly, C. M. WEED (*Amer. Nat., 31 (1897), No. 366, pp. 500–502, fig. 1*).

A new form of buccal apparatus of Hymenoptera, J. PEREZ (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 4, pp. 259, 260*).—Among the short-tongued bees the author has found a modification of the tongue in which the ligula is much reduced and of a recurved specular form, covered with small bristles. Contrary to the rule in Andrenidæ, the labial palpi are so greatly developed that each of their 4 joints is longer than the ligula. The first joint is cylindro-conical, slightly curved toward the base; the second and third are flattened and have smooth inner surfaces, each of which has a minute furrow, which, when the palpi are brought together, forms, with the one of the opposite side, a small canal. The fourth joint is flexible, with an external curved and uneven surface. Its somewhat concave internal face forms the origin of the canal. Liquids are taken up through the canal to the ligula. The insect seems to be related to *Andrena julliani*.

Facts about Podisus placidus, A. H. KIRKLAND (*Amer. Monthly Micros. Jour., n. ser., 18 (1897), No. 6, pp. 191, 192*).—This bug was watched while it was feeding on gypsy moth larvæ.

Parasites of grain crops, G. MCCARTHY (*North Carolina Sta. Rpt. 1896, pp. 147–155*).—A reprint of Bulletin 128 of the station (E. S. R., 8, p. 507).

Insects affecting the cotton plant, L. O. HOWARD (*U. S. Dept. Agr., Farmers' Bul. 47, pp. 32, figs. 15*).—A reprint from Office of Experiment Stations Bulletin 33 (E. S. R., 8, p. 686). The cotton worm (*Aletia argillacea*), cotton boll worm (*Heliothis armigera*), Mexican cotton boll weevil (*Anthonomus grandis*) are considered in detail, and the following mentioned: *Feltia annexa, F. malefida, Noctua c-nigrum, Agrotis ypsilon, Plusia rogationis;* the plant lice, *Aphis gossypii, A. citrulli*, and *A. cucumeris;* the leaf-feeding insects, *Cacœcia rosaceana, Dichelia sulphureana, Citheronia regalis, Eacles imperialis, Ecpantheria scribonia, Hyperchiria io, Leucarctia acræa, Spilosoma virginica, Arctia phyllira, Thyridopteryx ephemeræformis, Oiketicus abbotii, Laphygma frugiperda, Prodenia commelinæ, P. flavimedia, Thecla pœas, Acronycta oblinita, Anisota senatoria, Pyrausta rantalis, Schistocerca americana, Brachystola magna, Œcodoma fervens;* the insects damaging the stalk, *Ataxia crypta*, and those injuring the boll, *Aræocerus fasciculatus, Platynota sentana, P. rostrana, Batrachedra rileyi, Homalodisca coagulata*, and *Dysdercus suturellus*.

Insects, J. T. STINSON (*Arkansas Sta. Rpt. 1896, pp. 105–117, figs. 9*).—A reprint from Bulletin 43 of the station (E. S. R., 8, p. 909).

Pests of vegetable crops and their treatment, G. MCCARTHY (*North Carolina Sta. Rpt. 1896, pp. 326–336, figs. 5*).—A reprint from Bulletin 132 of the station (E. S. R., 9, p. 74).

The Agrillus of the pear, GITTON (*Rev. Hort., 69 (1897), No. 6, pp. 133, 134*).—On *Agrillus sinuatus*. The account differs from one given by P. Passy as noted below in describing the sinuous passages as reaching down the stem for 80 cm. to 1 meter. All parts attacked perish except in very vigorous trees where the cambium is very abundant, but this is not the rule.

An enemy of the pear, Agrillus sinuatus (Olivier), P. PASSY (*Jour. Hort. France, 3. ser., 19 (1897), June, pp. 527–535, figs. 4*).—The author tells of his finding this borer in pear twigs and gives a description of it and of its habits; notes the varieties of trees attacked, and suggests remedies. The larvæ is described as entering the twig in June or July from an egg laid on the outside and making a winding passage downward within the stem beneath the bark for a distance of from 60 to 80 cm. or more. He notes that his observations are at variance with those made independently and at about the same time by Dr. Puton as given by M. Gitton. (See above.)

According to Dr. Puton, the galleries are from 25 to 30 cm. in length, nearly straight, and the insect attacks only isolated trees; while according to the observations of the author both isolated trees and those in hedges are attacked.

Further, Dr. Puton found the insect attacking indifferently the pear and the apple, while the author found them only in pear trees, although apple trees were growing near by. Dr. Puton also found the insect attacking *Sorbus aucuparia.*

The remedy of cutting off and destroying affected twigs is recommended

Contributions to a monograph of the Aphids of Coniferæ, I, N. CHLOLODOVSKY (*Beiträge zu einer Monographie der Coniferenlause. St. Petersburg, 1896, pp. 61; abs. Zoöl. Centbl., 4 (1897), 13, pp. 453–455*).—This forms the concluding (7th) chapter of Part I of the monograph and deals with the genus Chermes and its relationships. Keys are given.

Chermes strobilobius Kalt. divides into 2 species; one, *C. strobilobius,* living on the larch, the other, *C. lapponicus,* upon the fir. The last is divided into 2 subspecies, *C. lapponicus præcox,* the galls of which open about the middle of June, and *C. lapponicus tardus,* the galls of which open at the end of July.

Report of the entomologist, C. H. FERNALD (*Massachusetts Hatch. Sta. Rpt. 1896, pp. 85–87*).—During the year somewhat extended studies were carried on on the spruce gall louse (*Chermes abietis*). Some time was also spent studying the various insects affecting cranberries, the elm leaf beetle, and the San José scale. The currant spanworm (*Diastictis ribearia*) is reported as stripping blueberry bushes, and the European scale, *Planchonia quercicola,* noted as injuring the golden oak in Worcester, Massachusetts.

Some injurious orchard insects, E. E. BOGUE (*Oklahoma Sta. Bul. 26, pp. 23, figs. 27*).—The author briefly and popularly describes—noting the common remedies in each case—the following insects: The apple leaf crumpler (*Phycis indiginella*), codling moth (*Carpocapsa pomonella*), apple tree tent caterpillar (*Clisiocampa americana*), bag worm (*Thyridopteryx ephemeræformis*), flat headed apple tree borer (*Chrysobothris femorata*), round headed apple tree borer (*Saperda candida*), twig girdler (*Oncideres cingulatus*), apple tree pruner (*Elaphidion villosum*), apple twig borer (*Amphicerus bicaudatus*), the fruit bark beetle or shot hole borer (*Scolytus rugulosus*), plum curculio (*Conotrachelus nenuphar*), peach tree borer (*Sannina exitiosa*), the bumble flower beetle (*Euphoria inda*), spotted vine chafer (*Pelidnota punctata*), rose chafer (*Macrodactylus subspinosus*), and the grapevine leaf roller (*Desmia maculalis*). The first insect is mentioned as being one of the most common insects in the orchards of Oklahoma. One man in 4 hours collected 1,584 cases from an orchard of 66 trees, of which 79 per cent were affected.

To the recorded food plants of the flat headed tree borer the Carolina poplar is added; and, while the spotted vine chafer is noted as not usually a troublesome insect, complaint is mentioned of its eating the foliage of the grape.

The subject of spraying apparatus is briefly discussed, and directions given for making Bordeaux mixture and kerosene emulsion.

Further notes on sections of Augochlora, C. ROBERTSON (*Canadian Ent., 29 (1897), No. 7, p. 176*).

An orchard scale, Aspidiotus biformis, T. D. A. COCKERELL (*Gard. and Forest, 10 (1897), No. 478, p. 158*).—The author mentions the places where he has found the scale and briefly speaks of its destructive features.

Description of the larva and pupa of Aulax nabali, T. W. FYLES (*Canadian Ent., 29 (1897), No. 4, pp. 79, 80*).

Contributions to coccidology, II, T. D. A. COCKERELL (*Amer. Nat., 31 (1897), No. 367, pp. 588–592*).—Breeding and other notes on 17 species. The new species *Dacty-*

lopius edmonthiæ and the new varieties *Asterolecanium bambusæ bambusulæ, Parlatoria theæ euonymi* are described. The osage orange is mentioned as a new food plant for *Aspidiotus juglans-regiæ albus.*

The Coleoptera of Canada. XXV. The Cerambycidæ of Ontario and Quebec H. F WICKHAM (*Canadian Ent., 29 (1897), No. 7, pp. 169–173, figs. 2*).

An enumeration of the Diptera thus far collected in Sicily, M. BEZZI and T. DE STEFANI-PEREZ (*Naturalista Siciliano, n. ser., 2 (1897), No. 1–3, pp. 25–72*).—After an introduction in which, among other things, some historical data are brought out showing the increase in the knowledge of the group, a copious bibliography is given. Then follows a classified list of the species of Diptera found on the island. The forms peculiar to Sicily are indicated.

Ichneumonidæ of Europe and bordering countries, G. V. BERTHOUMIEN (*Ann. Soc. Ent. France, 65 (1897), Nos. 2, pp. 285–336; 3, pp. 337–419*).

Some new and little-known Dorydini (Tassinæ), C. F. BAKER (*Canadian Ent., 29 (1897), No. 6, pp. 157–159*).

Larvæ of British Lepidoptera, W. BUCKLER (*Noted in Jour. Roy. Micros. Soc. London, 1897, No. 3, p. 202*).—The seventh volume of "The larvæ of the British butterflies and moths" deals with the first portion of the Geometræ.

New Hymenoptera from New Mexico, T. D. A. COCKERELL (*Entomologist, 30 (1897), No. 408, pp. 135–138*).—The following new species and varieties are described: *Cerceris acanthophilus, Encerceris vittatiferons* var. *tricolor, Spilomena foxii, Photopsis mesillensis, Melissodes menuacha* var. *submenuacha*, and *Andrena aliciarum.*

A new mealy bug (Dactylopius pseudonipæ), T. D. A. COCKERELL (*Science Gossip, n. ser., 3 (1897), No. 35, p. 302*).—The author studied specimens taken from a palm in California.

Larva of Thrixion halidayanum, T. PANTEL (*Compt. Rend. Acad. Sci. Paris, 124 (1897), pp. 194–197; abs. in Jour. Roy. Micros. Soc. London, 1897, No. 3, p. 201*).—Some of the structural peculiarities of this dipterous larvæ are described. The gut is simplified by parasitism. The gastric appendages are suppressed and the proventriculus is replaced by a hard muscular cushion on the upper wall of the esophagus. A peculiar organ is formed on each side of a somite by a group of giant cells. Its function is thought to be excretory.

Preliminary studies of North American Gomphinæ, T. G. NEEDHAM (*Canadian Ent., 29 (1897), No. 7, pp. 164–168*).—A key for the identification of the imagoes of the legion Gomphus and one for Gomphine nymphs is given.

Report of the State Entomologist of Norway for 1895, W. M. SCHÖYEN (*Rpt. Dept. Agr. Norway 1895, pp. 55–88*).

Analyses of insecticides, H. D. HASKINS (*Massachusetts Hatch Sta. Rpt. 1896, p. 249*).—The averages of a number of analyses of 11 insecticides are tabulated.

Bug Death, W. P. BROOKS (*Massachusetts Hatch Sta. Rpt. 1896, p. 143*).—Experiments with this substitute for Paris green showed that although it is more or less effective it does not act as quickly and in showery weather is not preferable to Paris green. Experiments with an atomizer for applying the Bug Death and furnished by the same company resulted very unfavorably to it. It requires 28 minutes to do the work that might be done with Leggett's gun in 8 minutes.

The San José scale disease, P. H. ROLFS (*Gard. and Forest, 10 (1897), No. 484, pp. 217, 218*).—Notes are given on *Sphærostille coccophila,* a fungus parasitic on San José and other scale insects.

Combating Injurious insects by means of their parasites, K. ECKSTEIN (*Ztschr. Pflanzenkrank., 7 (1897), No. 2, pp. 111–116*).

FOODS—ANIMAL PRODUCTION.

The distribution of galactan, J. B. LINDSEY and E. B. HOLLAND (*Massachusetts Hatch Sta. Rpt. 1896, pp. 92–96*).—The method of determining galactan, which is recognized as being imperfect in some respects, is described, and the results are given of the determination of galactan in a large number of coarse and concentrated feeding stuffs, seeds, by-products, etc. The results are also calculated to galactose. The method is not considered reliable for amounts of galactan under 1 per cent.

"The results as given show the presence of very small amounts of galactan in the nonleguminous coarse fodders and seeds. In the leguminous plants from 3 to 4 per cent are present, while in case of the leguminous seeds several varieties of beans and peas appear to contain very limited quantities, but the larger number of such seeds tested show from $1\frac{1}{2}$ to as high as 14 per cent. With the exception of the lupines, the clover seeds contain the largest amounts, the seeds of white variety containing 9 per cent.

"The results are merely a report of progress. They show, however, that the galactans are not as widely distributed nor present in such large quantities as are the pentosans, and therefore do not play such an important part as do the latter in the process of nutrition. We propose to continue the investigation of the distribution of these substances, and also to determine their digestibility."

On the distribution of fat and protein in the bodies of animals poor in flesh, together with observations on a method of determining fat, M. SCHULZ (*Arch. gesam. Physiol.* [*Pflüger*], *66, No. 3-4, pp. 145-166*).—The nitrogen and fat in the tissues and organs of 2 lean dogs were determined. The suitability for this purpose of Dormeyer's[1] method of estimating fat was studied. The principal conclusions reached were the following: Dormeyer's method of estimating fat (digesting the substance with pepsin and hydrochloric acid before extracting it) can be used for determining the fat in the different organs and tissues. From appearances it is impossible to tell whether an animal is actually fat or lean. By a comparatively long period of fasting it is impossible to reduce the fat content of the body to the lowest limit. The nitrogen content of the different organs when dry and free from fat is about the same.

Digestion experiments with sheep, J. B. LINDSEY, E. B. HOLLAND, and G. A. BILLINGS (*Massachusetts Hatch Sta. Rpt. 1896, p. 135*).—A very brief report is given of experiments with sheep made during the year on the digestibility of rice meal, Pope gluten feed, Pope gluten meal, millet and soy-bean silage, corn and soy-bean silage, and hay (mostly timothy). The results are shown in the following table:

Coëfficients of digestibility of feeding stuffs.

	Dry matter.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Rice meal (2 trials)	74	62	91	92	....
Pope gluten feed (2 trials)	87	86	81	90	77
Pope gluten meal (2 trials)	93	84	98	88	....
Millet and soy-bean silage (4 trials)	59	57	72	59	69
Corn and soy-bean silage (3 trials)	69	65	82	75	65
Hay (mostly timothy)	55	54	57	55	57

[1] Arch. gesam. Physiol. [Pflüger], 64, p. 341; 65, p. 96 (E. S. R., 7, p. 919)

The rape crop, its growth and value for soiling and fattening sheep and swine, J. A. CRAIG (*Wisconsin Sta. Bul. 58, pp. 16, figs. 9*).—The culture of rape is treated of briefly, and general directions are given for feeding rape to lambs based on the results of a number of years' experiments at the station.

"The results of our experiments in fattening lambs on rape show that the average gain per head weekly has been 2½ lbs. About 1 lb. of grain per head daily has been the average amount fed with the rape. Using our results in a conservative way, it may be said that if 40 lambs are fed off an acre of rape and given some pasture and an average of 1 lb. of grain per head daily they will produce at least 400 lbs. of mutton from the acre in 1 month."

Two tests of feeding rape to pigs are briefly reported. The first trial was made with 2 lots of 10 pigs each. One lot was fed in a pen a grain ration of corn and shorts, 2 : 1. The corn was soaked and mixed with bran in a slop. The other lot received a less amount of the same grain ration and in addition were allowed the run of a thirty-two-hundredths-acre field of rape. In 76 days the 10 pigs on rape consumed 1,386 lbs. of corn and 690 lbs. of shorts and gained 853 lbs. The lot fed in a pen consumed 2,096 lbs. of corn and 1,042 lbs. of shorts and gained 857 lbs. The gains were practically the same in each case. In other words, the rape grown on thirty-two-hundredths of an acre was equivalent to 1,062 lbs. of grain.

The second trial was made with 2 lots of 19 pigs each. The grain ration and the experimental conditions were the same as before. The lot on rape had the run of six-tenths of an acre. In 49 days this lot consumed 2,220.3 lbs. of corn and 1,109 lbs. of shorts and gained 1,066 lbs. The lot fed grain only consumed 3,106.5 lbs. of corn and 1,553 lbs. of shorts and gained 1,076 lbs. In this trial also the gains of the 2 lots were practically the same. The rape from six-tenths of an acre was equivalent to 2,217 lbs. of grain. Taking the average of the two trials, 1 acre of rape was equivalent to 2,767 lbs. of the grains fed.

"At various times we have tried feeding pigs on rape and it has always been satisfactory, though it would sometimes be necessary to restrict the other feed until the pigs became acquainted with the taste of the plant. . . .

"The 2 trials . . . indicate that this crop is likely to prove as valuable for swine feeding as it is for sheep. There is less risk in feeding it to swine, as they do not bloat on it nor scour if fed properly. It gives every promise of proving an excellent crop for pasturing brood sows and young pigs. . . . Rape seems specially valuable for swine feeding during the hot summer months because of its succulence and the relish of swine for it, and for these reasons we would urge our swine breeders and feeders to try it on a small scale for this purpose."

Feeding experiments with pigs, J. B. LINDSEY, E. B. HOLLAND, and G. A. BILLINGS (*Massachusetts Hatch Sta. Rpt. 1896, pp. 126–134*).—Two experiments are reported, to test the comparative value of rice meal and corn meal and of oat feed and corn meal for pigs.

Rice meal vs. corn meal (pp. 226–230).—This test, which began December 12 and lasted 4 months, was made with 6 Chester White pigs from the same litter, divided into 2 equal lots. The pigs were about 1½ months old at the beginning of the experiment. They were kept in separate pens, which were quite roomy. Both lots were fed 5 to 6 qt. of skim milk daily. At the beginning of the trial, lot 1 was fed 4 oz. of rice meal to a quart of milk and lot 2 4 oz. of corn meal. The amount was gradually increased to suit the appetite of the pigs. The amount of total solids in the skim milk was determined from time to time. The composition of the rice meal and corn meal is given. The two feeding stuffs have similar composition, "being comparatively low in protein and high in carbohydrates. They both may be termed heat-producing and fattening feeds. The rice meal contains more fat and less extract or starchy matter than the corn meal."

The results, which are expressed in tabular form for each pig, are briefly summarized in the following table:

Results of feeding rice meal and corn meal to pigs.

	Food consumed.			Weight at beginning.	Daily gain in weight.	Loss of weight in dressing.	Dry matter eaten per pound of gain.
	Skim milk.	Rice meal.	Corn meal.				
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*	*Pounds.*
Lot 1 (average per pig)	1,172.8	288.87	....	67	1.41	22.64	3.77
Lot 2 (average per pig)	1,172.8	....	288.87	65	1.42	19.96	3.59

"The above results indicate that a good quality of rice meal has a feeding value equal to a similar quality of corn meal.

"With grain at $18 per ton and dressed pork at 5 cts. per pound, skim milk returned ½ ct. per quart, or 23 cts. per 100 lbs.; with the same price for grain and dressed pork at 6 cts. per pound, skim milk would return 31.5 cts. per 100 lbs.

"With grain at $18 per ton and skim milk at 15 cts. per 100 lbs., live weight would cost 2.88 cts. per pound and dressed weight 3.66 cts. If skim milk were reckoned at 25 cts. per 100 lbs., live weight would cost 4 cts. per pound and dressed weight 5 cts. per pound."

Oat feed vs. corn meal (pp. 231–234).—This test, which began March 29 and lasted 3 months, was made with 6 Chester White pigs from the same litter. They were divided into 2 lots, lot 1 consisting of 4 and lot 2 of 2 pigs. The conditions were the same as in the previous test. The pigs were given at the beginning 5 qt. of skim milk per day, which was gradually increased to 8 qt. At first lot 1 was fed in addition 2 oz. of oat feed and lot 2 2 oz. of corn meal to a quart of milk, the amounts being increased later to satisfy the appetite of the pigs. The composition of the oat feed and the corn meal is reported. The results, which are given for each pig, are briefly summarized in the following table:

Results of feeding oat feed and corn meal to pigs.

	Food consumed.			Weight at beginning.	Daily gain in weight.	Dry matter eaten per pound of gain.
	Skim milk.	Oat feed.	Corn meal.			
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Lot 1 (average per pig)	1,347.24	217.3	....	42.56	1.03	3.50
Lot 2 (average per pig)	1,347.24	....	217.3	45.25	1.22	2.86

"The present experiment shows that only 83.6 per cent as much pork was produced with oat feed as with an equal weight of corn meal, or 100 lbs. of corn meal were equal to 120 lbs. of oat feed.

"With corn meal at $18 per ton, oat feed at $16 per ton, and dressed pork at 5 cts. per pound, skim milk returned $\frac{1}{3}$ ct. per quart, or 15.6 cts. per 100 lbs. in case of the entire lot of 6 pigs.

"With the same price for grain, and skim milk reckoned at $\frac{1}{4}$ ct. per quart, live weight would cost 3.34 cts. and dressed weight 4.3 cts. per pound."

Poultry experiments, W. P. BROOKS (*Massachusetts Hatch Sta. Rpt. 1896, pp. 46–49*).—Experiments were made to test the effect upon egg production of condition powder and the comparative value of dry animal meal and cut fresh bone for egg production.

Effect of condition powder upon egg production (pp. 146–148).—This test, which began February 9 and lasted 79 days, was made with 2 lots of fowls, each consisting of 3 Barred Plymouth Rock hens, 8 Light Brahma hens, 6 Light Brahma pullets, and 2 Wyandotte-Light Brahma pullets. One hen in each lot died before the end of the test. The hens were $1\frac{3}{4}$ years old at the time the test began. Each lot occupied a separate house with a scratching shed and room for nesting and roosting. They had access at all times to fresh water and were supplied with grit. Both lots were fed whole wheat, whole oats, wheat bran, wheat middlings, ground clover, new-process linseed meal, animal meal, soy-bean meal, and cut bones. The bran, middlings, ground clover, and bones were given in the form of a mash in the morning. The grains were scattered in the straw in the scratching shed twice a day. The nutritive value of the ration was 1:4.5. Lot 1 was given with the mash a commercial condition powder according to the directions furnished with it. The composition of the feed is reported. The results of the test are shown in the following table:

Results of feeding poultry with and without condition powder.

	Food consumed.	Cost of food per day per fowl.	Number of eggs produced.	Dry matter in food per egg.	Cost of food per egg.
	Pounds.	*Cent.*		*Pounds.*	*Cents.*
Lot 1 (condition powder)	291.6	0.23	163	1.61	2.1
Lot 2	289.5	.23	195	1.33	1.8

The cost of the condition powder is not included in the above estimate It amounted to $1, and would have increased the cost per egg for lot 1 to 2.7 cts.

All the fowls appeared in good condition at the end of the test. The hens receiving no condition powder began to lay several days before those receiving it. There was no material difference in the size or appearance of the eggs from the 2 lots. The lot receiving condition powder began to molt before the other lot. The test will be repeated.

Animal meal vs. cut bone for egg production (pp. 148, 149).—This test, which began February 9 and lasted 79 days, was made with 2 lots of fowls, each consisting of 2 Barred Plymouth Rock hens, 10 Light Brahma hens, 5 Light Brahma pullets, and 2 Wyandotte-Light Brahma pullets. The general conditions were the same as in the preceding test. Both lots were fed whole wheat, whole oats, wheat bran, wheat middlings, Chicago gluten meal, and ground clover. In addition, lot 1 received cut bone and lot 2 animal meal. The nutritive ratio of the ration for lot 1 was 1:4.8, for lot 2, 1:4.9. The results of the test are briefly shown in the following table:

Animal meal vs. cut bone for egg production.

	Food consumed.	Cost of food per day per fowl.	Number of eggs produced.	Dry matter in food per egg.	Cost of food per egg.
	Pounds.	*Cent.*		*Pounds.*	*Cents.*
Lot 1 (cut bone)	283.5	0.22	269	0.94	1.2
Lot 2 (animal meal)	287.0	.22	145	1.80	2.2

In the author's opinion the results indicate a decided advantage in favor of bone. No difference was observed in the condition of the 2 lots or in the character or size of the eggs produced. The experiment is being repeated.

On the utilization of beet molasses, A. G. EKSTRAND (*K. landt. Akad. Handl. Tidskr., 35 (1896), pp. 222–239*).—A discussion of the various methods of utilizing the beet molasses in European countries, with special reference to Swedish conditions, viz, for sugar extraction, for the manufacture of alcohol, compressed yeast, potash, illuminating gas, and for cattle food, singly or mixed with other feed stuffs, like bran, beet pulp, etc., or with peat dust (sphagnum moss).—F. W. WOLL.

Concerning wheat and its mill products, G. L. TELLER (*Arkansas Sta. Rpt. 1896, pp. 61–73*).—A reprint from Bulletin 42 of the station (E. S. R., 8, p. 913).

Composition of the ash of wheat and its mill products, G. L. TELLER (*Arkansas Sta. Rpt. 1896, pp. 70–72, 75–80*).—A reprint from Bulletin 42 of the station (E. S. R., 8, p. 914).

Composition of pie melon, G. L. HOLTER and J. FIELDS (*Oklahoma Sta. Bul. 25, pp. 5, 6*).—The pie melon (stock melon) is described and its composition compared with that of other coarse foods. Analysis of the whole melon, including seeds and rind, shows a water content of 93.03 per cent. The dry matter contains 7.97 per cent protein, 58.90 per cent nitrogen-free extract, 3.77 per cent fat, 22.02 per cent crude fiber, and 7.34 per cent ash.

Compilation of analyses of fodder articles and dairy products, 1868–1897, E. B. HOLLAND (*Massachusetts Hatch Sta. Rpt. 1896, pp. 138–153*).—A reprint, with additions, of matter from the Annual Report of the station for 1895 (E. S. R., 8, p. 426).

Tables of the digestibility of American feed stuffs, J. B. LINDSEY (*Massachusetts Hatch Sta. Rpt. 1896, pp. 158–169*).—A reprint, with additions, of matter from the Annual Report of the station for 1895 (E. S. R., 8, p. 427).

The action of X-rays on the temperature of animals, L. LECERCLE (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 4, pp. 234, 235*).—The hind quarters of rabbits were freed from fur and submitted to the action of X-rays. The skin and rectal temperatures were lowered somewhat by the operation, but rose again to the initial point one-half hour after the close of the experiment.

Sheep feeding, J. A. CRAIG (*U. S. Dept. Agr., Farmers' Bul. 49, pp. 24*).—In a popular bulletin the author discusses the feeding of breeding ewes, rams, lambs intended for breeding purposes, and lambs for market. The results of investigations at several stations are quoted and summarized, and practical deductions are given.

Pork production on crops gathered by hogs. A succession of crops for hogs, R. L. BENNETT (*Arkansas Sta. Rpt. 1896, pp. 45–57*).—A reprint from Bulletin 41 of the station (E. S. R., 8, p. 17).

Standard varieties of chickens, G. E. HOWARD (*U. S. Dept. Agr., Farmers' Bul. 51, pp. 48, figs. 42*).—Descriptions, in most cases accompanied by cuts, are given of a large number of breeds of chickens.

Poultry keeping for profit, F. E. HEGE (*North Carolina Sta. Rpt. 1896, pp. 205–260, figs. 40*).—A reprint of Bulletin 130 of the station (E. S. R., 8, p. 720).

Why not improve your poultry? F. E. HEGE (*North Carolina Sta. Rpt. 1896, pp. 91–96*).—A reprint of Bulletin 126 of the station (E. S. R., 8, p. 521).

DAIRY FARMING—DAIRYING.

The cleaning of milk, BACKHAUS (*Milch Ztg., 26 (1897), No. 23, pp. 357–359*).—The author reports numerous experiments on the dirt in milk and on the means of removing it. He found that the germ content was practically proportional to the amount of dirt. About one-half of fresh cow dung dissolves in milk, so that it can not be estimated by the determination of the amount of dirt. For the latter determination it is recommended to allow to settle and filter through glass wool. Sieves and strainers were not found to clean the milk satisfactorily, but cleaning by centrifuge was found satisfactory from a mechanical and bacteriological standpoint. The bacteria pass into the separator slime for the most part. The germ content of the milk examined ranged from 302,000,000 per gram of ordinary milk to 1,013,000,000 in dirty milk. The cream showed a higher bacteria content than the skim milk. The disadvantage of cleaning by centrifuge is said to be that, aside from being troublesome, the milk thus treated does not throw up as much cream, which causes customers to regard it as poorer in fat.

Filtration through paper or through filter presses was not found satisfactory. Filtering through sand removed the dirt but not the bacteria. Filtering through cellulose was successful from both the mechanical and bacteriological standpoint. The cellulose is only used once. In conclusion the author says: "The fact that the impurities of milk are largely dissolved and the undissolved portion is removed either imperfectly or with great difficulty by any means at present available shows the need of making every effort to reduce the impurities by careful milking and treatment."

The influence of silage odors in the air on milk, F. H. KING and E. H. FARRINGTON (*Wisconsin Sta. Bul. 59, pp. 25–28*).—To test the strength of the objection frequently made against silage, and especially against building silos in dairy barns, a series of observations were made in 1894 upon the possibility of silage imparting a flavor or odor to milk and butter.

"As a result of these observations it was demonstrated beyond question that when silage is fed a short time before milking a sweetish odor is imparted to milk by which it may be detected from milk not produced from silage. It was further demonstrated that if the silage is fed to cows just after milking, in the majority of cases milks so produced could not be separated by the sense of smell, from non-silage milks. . . .

"It should be noted here also that we found that while butter made from milk having the sweetish silage odor also possessed that same odor sufficiently marked to enable one familiar with it to classify the butter as being produced from silage milk, yet Chicago experts gave the silage butter in this case a higher score in point of flavor."

In the spring of 1897 other experiments were made by the authors. A quantity of sweet milk was divided into 2 lots, one of which was placed inside the silo upon the silage for 1 hour. Both lots were then poured into a number of cans and examined by a number of competent persons to see if they could detect the silage odor in the milk. Out of 120 such examinations the results in 13 cases, or more than 10 per cent, were incorrect. Again, 2 lots of the same milk were taken to the silo, one being exposed within the silo, as above, for 1 hour, while the other had the air of the silo forced through it for the same length of time. Both lots were placed in cans and examined by experts as before. In 7 out of the 24 examinations the milk was pronounced as having no silage odor, "and it was agreed that the odors taken up by these milks were much less pronounced than is found in milks produced where silage is fed just before milking."

To study the effect, if any, of silage odors on the acidity of milk, a quantity of sweet milk was divided into 2 lots, one being taken to the silo where, with a small hand bellows, air from the silo was forced through the milk 1,000 times. Both lots were tested for acidity, the milk treated in the silo indicating less acidity than the other lot. In other cases both lots of milk were aërated alike, except that one lot was aërated with silo air and the other with outside air. Aëration decreased the acidity and about equally in case of both lots.

Fat determinations in samples of milk by different methods (*Nord. Mejerie Tidn., 11 (1896), p. 159*).—Ten samples of milk were analyzed at 6 Swedish chemical stations by the method ordinarily used at the station. The following results were obtained:

Fat content of milk as determined by different methods.

Sample of milk.	Adams's method.	Drying on sand.	Drying on granulated kaolin.	Adams's method, milk sour; ammonia added.	Adams's method.	Rose-Gottlieb method.[1]	Widest difference.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
No. 1	3.27	3.10	3.17	3.20	3.09	3.22	0.18
No. 2	3.05	2.74	2.90	2.95	2.85	2.96	.29
No. 3	3.40	3.06	3.26	3.32	3.14	3.32	.34
No. 4 (same as 2)	3.05	2.78	2.95	3.00	2.90	2.96	.28
No. 5 (same as 3)	3.37	3.02	3.20	3.38	3.21	3.35	.36
No. 6 (same as 1)	3.24	2.96	3.14	3.32	3.03	3 22	.28
No. 7	.25	.18	.19	.25	.19	.23	.07
No. 8	.24	.22	.17	.25	.18	.23	.07
No. 9 (same as 7)	.25	.17	.18	.23	.18	.23	.08
No. 10 (same as 8)	.29	.16	.19	.18	.16	.23	.13

[1] Landw. Vers. Stat., 40, p. 1.

The greatest difference obtained in case of whole milk was 0.34 per cent and in case of skim milk 0.13 per cent. The results are pronounced highly unsatisfactory, and the adoption of uniform methods of analysis is urged.—F. W. WOLL.

Gerber's milk test (acid butyrometer), N. ENGSTRÖM (*18de Allm. Svenska Landtbruksmötet, Malmö, 1896. Lund, 1896, pp. 62–66*).—Thirty-nine comparative analyses of milk were made by the Gerber butyrometer and the Adams method. The average results obtained were: Gerber's test, 2.89 per cent; gravimetric method, 2.90 per cent. The maximum difference between the results by the 2 methods on the same sample was 0.13 per cent, and between duplicates with the Gerber test, 0.15 per cent. By the Gerber method 83.3 per cent of the results came within 0.05 per cent. The possible error arising from the amyl alcohol used is shown, and it is recommended to check the results found with new lots of amyl alcohol by gravimetric analysis or to buy alcohol only from firms handling the test.—F. W. WOLL.

Report of Swedish chemical control stations for 1895 (*Rpt. Royal Swedish Agl. Dept., 1895, pp. 250–275*).—The 7 State control stations[1] in operation in 1895 examined in all 36,732 samples during the year, four-fifths of which were dairy products.

The report gives a discussion of the results of the examinations, with average data for the various kinds of soils, fertilizers, feeding stuffs, etc., analyzed. The analyses of milk made at the Vesterås chemical station are sufficiently numerous to show the changes in Swedish herd milk throughout the year:

Monthly averages for Swedish herd milk—Vesterås station.

Month.	Number of samples.	Average fat content.	Month.	Number of samples.	Average fat content.
		Per cent.			Per cent.
January	1.164	3.50	August	1,464	3.55
February	1,036	3.54	September	1,217	3.41
March	1,268	3.50	October	1,365	3.52
April	1,472	3.35	November	1,441	3.44
May	1,631	3.26	December	1,369	3.43
June	1,375	3.40			
July	1,383	3.36	Average for year	16,185	3.42

The effect of narrow and wide rations on the quantity and cost of milk and butter, and on the composition of milk, J. B. LINDSEY, E. B. HOLLAND, and G. A. BILLINGS (*Massachusetts Hatch Sta. Rpt. 1896, pp. 100–125*).—Two experiments comparing wide and narrow rations were made with 6 cows divided into 2 uniform lots of 3 each. The first experiment began October 24 and continued 52 days. It was divided into 2 periods of 26 days each.

The cows were fed a basal ration of hay and sugar beets. In addition, during the first period one lot was fed wheat bran and Chicago

[1] Jönköping, Kalmar, Halmsted, Skara, Örebro, Vesterås, and Hernosand.

gluten meal in such quantities as to furnish 3.07 lbs. of digestible protein, making the nutritive ratio 1:3.86. The other lot was given wheat bran and corn meal in such quantities as to furnish 1.46 lbs. of digestible protein, making the nutritive ratio 1:9.43. During the second period the rations were reversed.

The second experiment began January 27 and continued 42 days, divided into 2 equal periods. The cows were fed a basal ration of hay and millet-and-soy-bean silage. In the first period one lot was fed, in addition, wheat bran, Chicago gluten meal, and linseed meal, furnishing 2.85 lbs. of protein and making the nutritive ratio 1:4.04; while the other lot was fed wheat bran and corn meal, furnishing 1.45 lbs. of protein and making the nutritive ration 1:8.85. In the second period the rations were reversed. Composite samples of the milk of each cow were taken for 5 days of each week.

The experiments are reported in detail in tabular form, including analyses of the milk and of the different feeding stuffs used. The financial results are based on the following prices of feeding stuffs per ton: Hay, $15; sugar beets, $5; mixed silage, $4; bran, $16 to $17; gluten meal, $22 to $23; linseed meal, $22; and corn meal, $16 to $17. The following table summarizes the results:

Comparison of wide and narrow rations on cows.

	Total yield.		Cost of food.			Composition of milk.		
	Milk.	Butter (calculated).	Total for period.	Per quart of milk.	Per pound of butter.	Total solids.	Fat.	Solids not fat.
First experiment:	*Pounds.*	*Pounds.*		*Cents.*	*Cents.*	*Per ct.*	*Per ct.*	*Per ct.*
Narrow ration	4,241.5	222.71	$36.84	1.89	16.74	13.66	4.51	9.15
Wide ration	3,695.5	192.01	35.34	2.11	18.41	13.56	4.47	9.09
Increase of narrow over wide ration	546.0	30.70	1.50	—.22	—1.67	....	....	....
Second experiment:								
Narrow ration	3,261.0	183.98	26.27	1.74	14.40	13.83	4.83	9.00
Wide ration	2,877.0	168.64	24.43	1.83	14.64	14.12	5.02	9.10
Increase of narrow over wide ration	384.0	15.34	1.84	—.09	—.24	....	....	....

"The above table shows that the narrow rations produced from 11.8 to 12.9 per cent more milk than did the wide rations, and that they reduced the cost of production from 5 to 12 per cent. . . .

"On the narrow rations the cows produced 13.7 per cent more butter in Experiment I and 8.3 per cent more in Experiment II than they did on the wide rations. In Experiment I the cost of feed per pound of butter produced was 16.74 cts. for the narrow ration and 18.41 cts. for the wide ration, showing that the narrow ration produced butter for 10 per cent less per pound than did the wide ration. In Experiment II the cost of feed per pound of butter produced was 14.57 cts. for the narrow and 14.64 cts. for the wide ration, showing a difference of but 1.67 per cent in favor of the narrow ration. . . .

"The manure from the narrow ration has 20 per cent more value than that from the wide ration. The cause of the increased value lies naturally in the increased amount of nitrogen present. . . .

"While the so-called narrow rations as used in these experiments were extreme ones, it might be said that narrow rations which contain from 2 to 2½ lbs. of digestible protein in a day's feed, aside from their causing a 10 per cent increase in the milk yield, furnish in addition a manure from 10 to possibly 15 per cent more valuable than do wide rations.

"While narrow rations will unquestionably produce more milk and butter than wide rations, the relative cost of the milk and butter produced by the two rations will depend upon the price of the concentrated feed stuffs. The markets, however, at the present time contain such a great variety of these products that the feeder can select those rich in protein at prices that will enable him to feed the narrow or so-called well-balanced rations to advantage. . . .

"The average weights of the animals during both periods of each experiment are practically identical. In the first experiment the milk appears to have suffered no change in composition. In the second experiment the wide ration seems to have slightly increased the solids and fat and diminished the nitrogenous matter."

The relative value of different animals used in the 2 experiments is brought out in a statement showing the yield and cost of butter from the best and the poorest cows.

"In Experiment I the best cow on the narrow ration produced 12.2 lbs. of butter per week, at a cost for feed consumed of 14 cts. per pound, while the poorest cow produced 8.26 lbs., at a cost of 19.37 cts. per pound. In the same experiment on the wide ration one cow produced 9.52 lbs. per week, costing 16.67 cts. per pound, and another 7.28 lbs. per week, costing 18.88 cts.

"In experiment II the best yield with the narrow ration was 12.81 lbs. of butter per week, costing for feed eaten 11.66 cts. per pound, and the poorest yield was 7.98 lbs., costing 15.90 cts. In the same experiment on the wide ration the best yield was 10.92 lbs. weekly, costing 12.71 cts. per pound, and the least yield 6.86 lbs. weekly, costing 16.21 cts. per pound."

Feeding experiments with skim-milk feed for milch cows, P. HANSSON (*Tidskr. Landtmän, 17 (1896), pp. 381–385; Nord. Mejerie Tidn., 11 (1896), pp. 257–259*).—An experiment is reported with 2 lots of 13 cows each, covering a preliminary period and 3 regular periods. Lot A received the regular winter ration throughout the experiment, consisting of hay, straw, and chaff, and 4.7 kg. of mixed concentrated feed, while lot B received 4 kg. of "skim-milk feed" per day per head, prepared according to Lindstrom's method (E. S. R., 8, p. 248) and fed in place of a portion of the grain feed. In the final periods both lots had the regular winter ration.

The results as to the value of the "skim-milk feed" were not as satisfactory as those reported by Lindstrom (loc. cit.). The influence of the composition of the ration fed with the "skim-milk feed" is pointed out, and further carefully planned and conducted experiments with the feed are recommended.—F. W. WOLL.

Experiments with stack silage conducted at Ultuna Agricultural Institute, 1896, H. JUHLIN-DANNFELT (*Rpt. Machinery Trials at Malmö Agl. Exposition, 1896. Lund, 1896, pp. 189–207*).—Two silage stacks (Blunt's and Hermelin's processes) were filled the latter part of June, 1895, with glyceria and marsh grass, about equal parts. Bacteriological and chemical analyses were made of the silage, and the results are recorded. The temperature of the Blunt silage during the first two weeks after filling ranged from 55 to 38° and the Hermelin silage from 68 to 52°. On opening the stacks in the early part of January, 1896, the temperature in the middle of the Blunt stack was 29° and of the Hermelin stack 27°, and 48.4 per cent of the mass was spoiled in the first and 35.7 per cent in the last case. The gain or loss of the two sorts of silage during fermentation was recorded.

A feeding experiment with 20 milch cows, divided into 4 uniform lots, was made to compare silage made as above and clover silage with fodder beets. The test was divided into 3 periods. In the first and third periods all the lots were fed a ration consisting of 5 kg. of beets and 6 kg. of clover silage, with wheat bran, ground barley and oats, ground peanut cake, ground rape seed cake, hay, and cut straw in addition. In the second period lot 1 was fed 5 kg. each of marsh grass silage and beets, lot 2 10 kg. of beets, lot 3 10 kg. of marsh grass silage, and lot 4 10 kg. of clover silage; all the lots receiving in addition the same grain, hay, and straw ration as in the first and third periods. The results are shown in the following table:

Results of feeding silage and beets to milch cows.

	Nutritive ratio.	Yield of milk per day.	Yield of milk fat per day.	Fat content of milk.
Lot 1:		*Pounds.*	*Pounds.*	*Per cent.*
First period (beets and clover silage)	1:5.3	24.97	7.37	0.38
Second period (marsh grass silage and beets)	1:5.7	22.08	7.43	.34
Third period (beets and clover silage)	1:5.3	21.91	7.21	.33
Lot 2:				
First period (beets and clover silage)	1:5.3	25.19	7.34	.38
Second period (beets)	1:5.3	23.96	7.01	.35
Third period (beets and clover silage)	1:5.3	22.96	7.04	.33
Lot 3:				
First period (beets and clover silage)	1:5.3	25.25	7.17	.37
Second period (marsh grass silage)	1:5.9	23.14	7.15	.34
Third period (beets and clover silage)	1:5.3	22.77	7.32	.35
Lot 4:				
First period (beets and clover silage)	1:5.3	25.45	7.08	.37
Second period (clover silage)	1:5.3	23.21	7.15	.34
Third period (beets and clover silage)	1:5.3	23.49	7.12	.35

The results in every case were practically the same, and the conclusion seems warranted that the 2 kinds of silage when fed in quantities not exceeding 22 lbs. per head daily have practically the same value as beets.—F. W. WOLL.

Tests of pure cultures for cream ripening, N. ENGSTRÖM (*18de Allm. Svenska Landtbruksmötet, Malmö 1896. Lund, 1896, pp. 69–72*).—Sixteen series of trials were made with 4 pure cultures for cream ripening manufactured by 3 different firms. The trials were conducted partly at Alnarp Dairy Institute, partly at the Hör creamery. The cream used had in all cases been pasteurized at 70° C. The butter was scored when a few days old, and again in a week. Only the differences between the scoring of the creamery butter and the experimental lots are given in the table.

Average scores of butter as compared with ordinary butter.

	Experiments at Alnarp (13 series).			Experiments at Hör (3 series).			Average.	
	No. of trials.	First scoring.	Second scoring.	No. of trials.	First scoring.	Second scoring.	First scoring.	Second scoring.
C. Hansen's pure culture	6	−0.2	−0.5	3	+0.6	−0.6	+0.2	−0.6
Barnekow's solid ferment	4	±0.0	−0.8	1	(−3.2)	(−4.2)	(−1.6)	(−2.5)
Barnekow's liquid ferment	6	±0.0	−1.3	3	−0.2	−1.1	−0.1	−1.2
Blauenfeldt and Tvede	10	+0.1	−1.0	3	+0.7	+0.3	+0.4	−0.4

"Judging from these data, there is no appreciable difference between the Blauenfeldt and Tvede and C. Hansen starters. Barnekow's ferments are somewhat behind these, but the poorer result is mainly due to the comparatively low score of a single lot in each series.

"After the close of the trials proper the 4 cultures were propagated daily for about 6 weeks after the cultures were started. All of them remained normal, and no difference worth mentioning could be distinguished between Barnekow's liquid, Blauenfeldt and Tvede, and C. Hansen's cultures in taste or odor. Barnekow's solid ferment was inferior to these 3, although only very slightly.

"Finally, it may be stated that the trials have shown that wherever good buttermilk is at hand there is no cause for adopting such acid starters. The judging of the butter made with pure cultures showed that its quality, although very good, was in no wise superior to that made from cream ripened by means of good buttermilk."—F. W. WOLL.

Comparative trials with the Radiator and the separator with churn, N. ENGSTRÖM and A. SJÖSTRÖM (*18de Allm. Svenska Landtbruksmötet, 1896. Lund, 1896, pp. 41–57*).—Three series of trials were made with the Radiator butter-making machine, and 2 series each with churning sweet cream and sour cream raised with a separator. Each series included 3 days' trials. The milk and cream were in all cases treated according to the best methods of manufacture. The milk was pasteurized at 68° C. previous to the separation of the cream. Careful weighings and chemical analyses were made of the various products. The following average results were obtained.

Results of trials with Radiator and with separator and churn.

	Amount of milk used.	Amount of buttermilk obtained.	Time required.	Capacity per hour.	Speed of bowl per minute.	Temperature.		Products obtained.		
						Pasteurization.	Churning.	Skim milk.	Buttermilk and butter.	Worked butter.
Radiator:	*Kg.*	*Kg.*	*Min.*	*Kg.*		*Deg. C.*	*Deg. C.*	*Kg.*	*Kg.*	*Kg.*
Series I	1,713.5	52.5	48.4	730	6,140	64.5	19.0	1,572.7	144.1	54.1
Series II	1,581.0	56.6	47.3	695	6,130	68.5	18.5	1,449.4	136.7	50.3
Series III	4,403.4	144.0	131.8	690	6,030	68.5	18.0	4,078.5	377.2	144.2
Separator and churn:										
Sour cream butter—										
Series I	3,466.5	....	[1]60.7	1,142	5,540	68.0	11.13	2,743.4	....	......
Series II	4,351.9	....	82.8	1,053	5,400	68.0		3,630.5	[2]563.6	155.9
Sweet-cream butter—										
Series I	3,157.5	166.4	58.3	1,139	5,550	68.0	13.14	2,922.9	255.6	111.7
Series II	4,222.1	248.0	79.5	1,125	5,570	68.0		3,915.0	368.6	145.3

[1] Time required for separation. [2] Buttermilk.

The average quantities of cream obtained in the separator-churn trials were. Sour-cream butter, 642.9 and 656.1 kg. for series I and II, respectively; sweet-cream butter, 344.9 and 483.3 kg. for series I and II, respectively. The principal analytical results are given in the following table:

Chemical analyses of milk and products.

	Fat in—			Composition of butter.		
	Whole milk.	Skim milk.	Butter-milk.	Water.	Fat.	Casein.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Radiator trials:						
Series I	3.15	0.32	[1] 8.46	14.65	82.23	....
Series II	3.17	.26	[1] 9.10	14.20	82.52	0.97
Series III	3.17	.23	[1] 7.57	13.52	83.47	....
Sour-cream butter:						
Series I	3.11	.09	....	....	....	....
Series II	3.20	.13	.26	12.41	84.49	....
Sweet-cream butter:						
Series I	3.21	.13	[1] 1.59	12.79	84.41	0.52
Series II	3.13	.12	[1] 2.49	11.86	85.26	....

[1] One analysis.

Since different quantities of milk were handled in the various trials and this had a varying composition, no direct comparison can be made from the figures given as to the relative efficiency of the 2 systems of making butter.

In the following table the results obtained have been calculated to a capacity of 2,000 kg. of milk—an average daily capacity for a Radiator—and a fat content in the milk of 3.17 per cent.

Summary of results.

	Milk used.		Fat content of milk.	Products obtained.			Milk per kilogram of butter.
	Whole milk.	Butter-milk.		Worked butter.	Skim milk.	Butter-milk.	
	Kg.	*Per cent.*	*Per cent.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*
Radiator	2,000	90	3.17	68.3	1,880	90	29.3
Sweet-cream butter	2,000	175	3.17	71.3	1,892	175	28.1
Sour-cream butter	2,000	....	3.17	71.1	1,668	[1] 228	28.1

[1] Amount of starter subtracted.

The power required in making butter by the Radiator process is much greater than in using the separator-churn method, when either sweet or sour cream butter is made. The power required in the 3 cases is as follows:

With Radiator, 5.5 actual horsepower during 3 hours.
With sweet-cream butter:
  For centrifuging 1 power during 2 hours;
  For churning 1.2 power during ½ hour;
  Total, about 1 power during 2½ hours.
With sour-cream butter:
  For centrifuging 1 power during 2 hours;
  For churning 1.2 power during 1½ hours;
  Total, about 1 power during 3¾ hours.

The amount of water and ice required for cooling the cream is another point greatly against the Radiator method. The following daily requirements of water of 10° C. and of ice for this purpose are estimated by the authors to be: Radiator, 1,900 kg. water, 145 kg. ice; sweet-cream churning, 450 kg. water and 90 kg. ice; and sour-cream churning, 675 kg. water and 70 kg. ice.—F. W. WOLL.

A test of hand separators, H. HAYWARD (*Pennsylvania Sta. Bul. 38, pp. 25*).—This bulletin describes a test of the following hand separators sent to the station for that purpose: Alpha Baby No. 3, Humming Bird No. 0, United States No. 5, United States Midget No. 7, Mikado, Empire No. 5, and National.

Trials were made in each case under what were considered favorable and unfavorable conditions. The tests began March 18, 1896, and continued at intervals throughout the year, but no two separators were tested at the same time. The cows were nearly all fresh at the beginning of the test. Twelve tests were made with each machine, and the results of these are tabulated and discussed. A summary follows:

Summary of tests of hand separators.

Name of separator.	Milk used.	Fat in milk.	Separating temperature.	Revolution of crank per minute.	Milk separated per hour.	Cream taken.	Fat in cream.	Fat in skim milk.	Proportion of total fat recovered in cream.
"Favorable" conditions:	*Pounds.*	*Per ct.*	*Degrees.*		*Pounds.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
United States No. 5	210.90	4.69	88.4	48.5	365.3	14.90	30.01	0.160	95.4
Mikado	154.29	5.21	87.7	53.5	223.0	17.20	29.30	.102	97.3
United States Midget No. 7	138.70	5.02	89.3	49.6	197.1	17.20	28.40	.090	97.6
Alpha Baby No. 3	176.20	4.64	87.7	42.0	677.8	11.70	38.00	.079	96.1
Empire No. 5	230.90	5.09	91.9	47.0	467.2	13.80	35.10	.108	95.4
Humming Bird	63.66	4.26	91.4	60.0	153.4	14.00	36.50	.083	....
National	149.00	5.19	90.5	54.1	312.6	17.44	28.49	.080	95.6
	160.52	4.96	89.5	50.6	342.3	15.09	31.75	.106	[1]96.1
"Unfavorable" conditions:									
United States No. 5	211.70	5.20	74.0	47.3	361.1	18.70	26.10	.119	94.3
Mikado	104.20	4.88	75.9	51.0	202.4	15.00	30.60	.180	94.3
United States Midget No. 7	116.30	4.82	79.5	46.6	178.7	17.20	26.59	.090	95.6
Alpha Baby No. 3	167.20	4.55	70.0	39.0	631.3	13.20	33.28	.260	97.0
Empire No. 5	173.04	5.02	79.1	45.0	435.9	13.80	34.10	.116	94.7
Humming Bird	55.80	5.14	78.0	55.3	153 1	17.60	28.13	.106	....
National	102.60	4.87	81.3	48.0	270.4	21.61	21.50	.104	95.3
	132.97	4.92	76.8	47.4	318.9	16.45	28.52	.146	[1]95.1

[1] Not including the Humming Bird.

"These trials show very little, if any, difference in completeness of skimming and the total amount of fat recovered in the cream between the different makes of separators used in the test.

"With one exception all the separators fulfilled the claims of their manufacturers as to capacity and efficiency of skimming.

"All the separators used in the trial did satisfactory work under a far wider range of conditions than is recommended by the manufacturers.

"Considerable difference seemed to exist between the various separators as to substantialness and durability.

"The cheaper and newer machines did as efficient work in these trials as the older and more expensive ones."

A wide difference was found between the separators with respect to ease of operation. Although no dynamometer was used, the list, according to ease of operation per 100 lbs. of capacity, is given as follows: National, Baby No. 3 or Mikado, Empire, Humming Bird, United States No. 5, Midget No 7.

The results of 18 trials in churning cream from the different separators are given: "The difference between the percentage of fat left in the buttermilk, with 3 or 4 exceptions, is within the limits of error, and, according to these results, there is practically no difference in the churnability of the cream obtained from different hand separators. A careful examination of the butter made in these churnings showed no difference in texture or flavor that could be detected, the butter being to all appearances similar in every respect."

The cheese industry: Its development and possibilities in Wisconsin, S. M. BABCOCK and H. L. RUSSELL (*Wisconsin Sta. Bul. 60, pp. 24, figs. 5, pls. 2*).—This bulletin gives statistical data relative to cheese making in the United States and the export trade, with remarks on the nutritive value of cheese, factors influencing the development of the cheese industry, development of the butter and cheese industry in the light of natural conditions, the historical development of the cheese industry in Wisconsin, and the advantages of Wisconsin as a cheese-producing State.

"It will be noted that the great dairy region of the country coincides in a general way with the corn belt. The distinctively cheese regions lie as a rule to the northward of the great butter States, although in some instances both dairy products are extensively manufactured within the limits of a single State. Within the present decade the limits of butter production have been extended greatly to the westward, so that the present and potential butter regions are not accurately represented by the conditions as reported in the census of 1890. The cheese regions, with the exception of a small but spreading area on the Pacific Coast, lie in the basin of the Great Lakes, which modify the climatic conditions to such an extent that the surrounding States are especially favored with reference to cheese production. Butter can be and often is made on an extensive scale in all of these sections, but the peculiar advantages necessary to successful cheese production are present to an unusual degree and have unquestionably been of importance in determining the development of cheese making in America."

Wisconsin is considered especially well adapted for cheese production from climatic, commercial, educational, and legal considerations.

"In the adaptation of any industry to its surroundings natural advantages exert a marked effect. A recognition of these is necessary in the successful prosecution of any business. Wisconsin, therefore, should recognize the great advantages which she possesses for the economic production of a high quality of cheese. By nature she seems predestined to be the great cheese State of the future. Her commercial advantages by reason of her geographical position, her transportation facilities, and the legal restrictions thrown about the manufacture and sale of spurious products give her a prestige that can not fail to keep her in the front rank if she maintains and improves the quality of her product, a result which is only possible through the uplift that comes from a recognition of her educational institutions."

Report on Swedish dairying, 1891-'95, with a list of Swedish creameries and cheese factories, G. LILJHAGEN (*Norrköping, 1897, pp. 164, 51; from Rpts.*

Royal Swedish Agl. Dept. No. 1, 1897, No. 36).—The report gives the amounts of butter and cheese exported from and imported into Sweden during the years 1891–'95; the number of Swedish creameries and cheese factories, and their total production; measures taken by the various county agricultural societies for the advancement of dairying; State and county dairy educational institutions; State butter exhibitions; dairy associations; freight rates for dairy products on the State railways on and after July 1, 1896; description of the methods of manufacture of two kinds of cheese adapted for export purposes, Swedish estate cheese (*"herrgårds-ost"*) and Gouda cheese; law of registered trade-marks of June 28, 1895; catalogue of dairy schools, dairy instructors, and creameries and cheese factories (by counties).

The number of creameries and cheese factories in operation at the end of 1895 was 1,793. At 1,420 of these butter only was manufactured, at 211 full-cream cheese, and at 162 butter and cheese (partly skim). The total production during 1895 was: Butter, 24,926,679 kg.; full-cream cheese, 2,123,287 kg.; half skims, 742,487 kg., and skims, 4,048,701 kg. The milk handled by the factories amounted to 741,441,981 kg., and the total number of patrons was 54,618.—F. W. WOLL.

Dairying in foreign countries, B. BÖGGILD (*Mælkeribruget i fremmede Lande. Copenhagen: Nord. Forlag, 1897, Pt. I*).—This companion volume of "Dairying in Denmark" by the same author will be published in 7 parts (at 1 krone, 26.8 cts.) during the current year. It will treat of dairying in its characteristic features in Switzerland, Italy, France, England, Scotland, Ireland, Holland, Germany, Finland, Sweden, Norway, and the United States.

Heating and ventilating stables, B. MARTINY (*Milch Ztg., 26 (1897), No. 16, pp. 145, 146, figs. 3*).

Contributions from dairy division, Mustiala experiment station, R. GRIPENBERG (*Meddelanden från Mustiala Försöksstations Mejeriafdeling. Aabo (Finland), 1896, pp. 123, 132*).—Separate print of papers and reports published by the auther during 1881–'96).

Dairying in Norway, 1896 (*Norsk Landmansblad, 16 (1897), pp. 13–15*).

Is a ration with a wide or a narrow nutritive ratio preferable for milch cows? B. MARTINY (*Fülhing's landw. Ztg., 46 (1897), No. 13, pp. 392–396*).—The article quotes at length work published in the Annual Report of Massachusetts Hatch Station for 1896 (E. S. R., 9, p. 380).

Milk and butter yield of ten Breitenburg cows, NEUMANN (*Milch Ztg., 26 (1897), No. 23, pp. 359–361*).

Effect of adding fat to the rations of milch cows (*Deut. landw. Ztg.; abs. in Milch Ztg., 26 (1897), No. 14, p. 216*).—The results of a number of experiments in adding fat or tallow to the rations of cows are reviewed. Tallow when fed for some time increased neither the yield nor the fat content of the milk. During the first two weeks the fat content appeared to be increased, but this effect disappeared later.

New milk-pasteurizing apparatus in Denmark, A. LAVALLE (*Milch Ztg., 26 (1897), Nos. 9, pp. 134, 135, figs. 3; 10, pp. 146–148, figs. 5; 11, pp. 162–164, figs. 2; 12, pp. 179–181, figs. 4*).

A new method of sterilization by heat under pressure (*Milch Ztg., 26 (1897), No. 15, p. 229*).

Pure lactic cultures of bacteria in cheese making, H. L. RUSSELL (*Jour. Roy. Agr. Soc. England, 3. ser., 8 (1897), I, pp. 141–152*).—A reprint from the Annual Report of the Wisconsin Station for 1896.

Observations from creamery practice, HOFFMANN (*Milch Ztg., 26 (1897), No. 14, pp. 212–214*).—Remarks on the payment for milk on the fat basis, the feeding of cows, production of milk by herds, etc.

Payment for milk at creameries, A. ARNSTADT (*Milch Ztg., 26 (1897), No. 11, pp. 161, 162*).

Investigations on some frequent defects in consistency of butter and their causes, and on the constitution of fat globules, V. STORCH (*Milch Ztg., 26 (1897),* *Nos. 15, pp. 228, 229; 16, pp. 243–245; 17, pp. 257–259; 18, pp. 273–275*).—An abstract of this paper from the original has already been given (E. S. R., 9, p. 176).

A new process for improving inferior butter, L. PIDERIT (*Milch Ztg., 26 (1897), No. 10, pp. 151, 152*).

The present status of the butter exports of Germany, BOYSEN (*Der Augenblickliche Stand des deutschen Butter-Exports. Bremen: M. Heinsius Nachfolger (1897)*.

Denmark's butter export, B. BÖGGILD (*Tidsskr. Landökon., 15 (1896), pp. 709–716*).

Finland's butter export, B. BÖGGILD (*Ugeskr. Landm., 42 (1896), pp. 558, 559*).,

German imports and exports of dairy products (*Milch Ztg., 26 (1897), No. 10 pp. 150, 151*).

Agricultural education in France, with special reference to the dairy schools, P. MEYER (*Milch Ztg., 26 (1897), No. 20, pp. 307, 308*).

VETERINARY SCIENCE AND PRACTICE.

Annual report for 1896 from the principal of the Royal Veterinary College, J. MCFADYEAN (*Jour. Roy. Agr. Soc. England, 3. ser., 8 (1897), I, No. 29, pp. 115–135, fig. 1*).—A report on rabies, anthrax, abortion in cows, the dangers attending the use of milking machines, and the following diseases:

Glanders.—Experiments were made with the serum of glandered horses which demonstrated that mallein acts in a peculiar way with live glanders bacilli, but it is thought that even if the reaction obtained with the serum is fully as accurate as that with mallein, it necessitates a too intimate acquaintance with biological methods for everyday practice.

Parasitic gastroenteritis.—An investigation of a serious disease in a herd of cattle brought to light numerous small worms in the stomachs of the animals affected. The worms were found upon microscopic examination of the walls of the stomach, and identified doubtfully with *Strongylus convolutus*, discovered by Ostertag in the fourth stomach of an ox. The chief difference between Ostertag's description, which is quoted, and the worms found by the author, lies in the presence of barb-like hooks on the neck and longitudinal ridges of the skin. Further, it is noted that the worms found do not agree with Ostertag's figure fully in the details of the caudal extremity, but these discrepancies are charged to inaccurate descriptions.

The principal symptoms produced by the worms are diarrhea and gradual loss of condition. The appetite is never affected. There was no cough, but otherwise the animals studied presented the general appearance of animals in the last stages of tuberculosis, though a physical examination brought forth no evidence of that disease.

The first fatal case in the herd in question occurred in 1879. From that time on the herd was never free from the disease, and it gradually increased so that in 1895 14 animals died. Most of the affected animals were young. When an old one was attacked the course of the disease seemed to be more rapid.

The treatment employed was an isolation of the affected animals and an allowance of a liberal diet with biweekly doses of turpentine.

Though not contagious in the ordinary sense of the word, the disease may be communicated to healthy animals by grazing them on the same ground with diseased animals. In view of this it was recommended that turpentine be given the healthy animals once a month.

Pneumonia of the pig.—During experiments on the causation of swine fever the absence of pneumonia in a large number of animals led to an investigation of this trouble as connected with swine fever. A request to a large number of veterinarians to send in the lungs of fever-affected animals showing evidences of pneumonia resulted in obtaining less than a dozen lungs. Some of the freshest of these were selected for microscopic examination and experimentation with rabbits, pigs, and pigeons. Five microörganisms were detected and found morphologically and culturally different from swine-fever bacillus and to belong to the hæmoragic septicæmia type. As found in the blood the most common form is short and rod-like, with rounded ends. It stains with aqueous methylene blue more intensely at the poles than in the middle, and then resembles somewhat a diplococcus. With these there always occur forms more distinctly bacillar. The bacteria in question are smaller than swine-fever bacilli and are further distinguished from it by being nonmotile and in cultures by their forming opaque, spherical, or oval well-defined colonies. The 5 organisms, though morphologically the same, vary in virulence for rabbits and pigeons.

In conclusion, it is thought swine-fever bacilli do not commonly cause pneumonia and that the presence or absence of pneumonic lesions will not enable one to determine whether or not the pig has been affected with swine fever.

Poisoning horses by spoiled potatoes.—In the examination of several cases of poisoning the poison was traced to feeding potatoes that were old, mildewed, and partly decayed. As the potatoes were steamed before feeding, the toxic effects are attributed to changes produced by bacteria or fungi similar to those in so-called "meat" poisoning. The first symptoms noticed were loss of power in the limbs, the animals lying or falling down and then being unable to get up. Toward the last there seemed to be some difficulty in swallowing. Eleven cases are noted as fatal. *Post-mortem* examination showed all of the principal organs in a healthy condition with the exception of the large intestine, the walls of which gave evidence of slight irritation.

On formic aldehyde as a means of influencing animal diseases, W. Eber (*Deut. landw. Presse, 14* (*1897*), *No. 61, p. 556*).—The author takes up the question as to the real utility of formic aldehyde and its commercial combinations—steriformin (a solution of formic aldehyde in a solution of milk sugar) and "holzin" (a solution of formic aldehyde in methyl alcohol). He comes to the conclusion that when taken internally the formic aldehyde is in so weak a solution as to be valueless. Inasmuch as it is not excreted in the urine, as shown by experiments in which large doses of steriformin were fed to a cow and the urine tested, it probably forms organic internal compounds.

The vapor is unquestionably a germicide and the aqueous solution is beneficial, used at the rate of 2 to 3 spoonfuls of a 35 per cent solution to a liter of water; but it can scarcely displace other disinfectants such as chlorin water or solutions of chlorid of lime or caustic soda. For the disinfection of manures it is valueless. As a disinfectant of wounds weak solutions are of no value and stronger and concentrated solutions are destructive to tissues.

Report of the veterinary department, A. W. BITTING (*Indiana Sta. Rpt. 1896, pp. 50–53*).—The author describes the work of the year on hog cholera, tuberculosis, and actinomycosis, and the station equipment. Eighty per cent of 10 cases of actinomycosis treated with a dram to a dram and a half of potassium iodid once a day for 2 weeks (and a repetition at the end of a week in those cases where it seemed necessary) recovered.

The spaying of mares, W. L. WILLIAMS (*Montana Sta. Bul. 12, pp. 96–103*).—Twenty mares were spayed. The operation, which is described at length, was successful in all cases. Most of the mares were apparently in normal health a few days after the operation.

Glanders, Texas fever, and symptomatic anthrax, L. L. LEWIS (*Oklahoma Sta. Bul. 27, pp. 18*).—A popular description is given of these three diseases and of their proper treatment. Tables are given showing the temperature records of horses diseased with glanders and treated at the station. The usual measures are recommended. Under the head of Texas fever a map is given showing the difference between the national and Oklahoma quarantine lines, the latter extending farther south than the former, or along the Canadian River.

The mallein test for suspected glanders in horses, R. R. DINWIDDIE (*Arkansas Sta. Rpt. 1896, pp. 40–42*).—A reprint from Bulletin 40 of the station (E. S. R., 8, p. 525).

Agglutination phenomena in glanders, A. G. R. FOULERTON (*Lancet* [*London*], *1897, No. 1, p. 1201; abs. in Jour. Roy. Micros. Soc.* [*London*], *1897, No. 3, p. 242*).—Agglutination of the glanders bacillus can be brought about by contact with serum from a case of active infection by the glanders bacillus, from active infection by typhoid bacillus, and from a horse immuned against diphtheria. Normal equine or human serum exhibit no such reaction.

Tuberculosis statistics in Bavaria, F. MAY (*München med. Wochenschr., 44* (*1897*), *No. 10, p. 254; abs. in Centbl. Bakt. u. Par., 1. Abt., 21* (*1897*), *No. 17–18, pp. 690, 691*).—It is stated that over 10 per cent of the deaths in Bavaria are due to tuberculosis. Of those dying at ages ranging between 15 and 61 years in 1889 to 1893, 11.84 per cent was due to tuberculosis. The percentage was as low as 11.19 per cent only in one year.

Contribution to the question of intra-uterin infection of offsprings with tuberculosis, F. HEUKE (*Arb. Path. Anat. Inst. Tübingen, 2* (*1897*), *No. 2, p. 268; abs. in Centbl. Bakt. u. Par., 1. Abt., 21* (*1897*), *No. 17–18, pp. 691, 692*).—Investigation of a child from a tuberculosis mother showed double-sided pneumonia and fresh fibrinous pleurites. There were no macroscopic tubercles. An inoculation of a Guinea pig with a nonsuspicious piece of bronchial tube the size of a pea resulted in the death of the Guinea pig in 37 days. An autopsy showed it to be severely affected. The author thinks that the bronchial tube contained living bacilli of tuberculosis and that they were of congenital origin. He changes Eberth's law, "man does not inherit but acquires tuberculosis," to "man acquires tuberculosis and also inherits it."

The biological status of Bacillus tuberculosis, A. C. JONES (*Rpt. 66th Meeting British Assn. Adv. Sci., 1896, pp. 1015, 1016; abs. in Jour. Roy. Micros. Soc.* [*London*], *1897, No. 3, p. 242*).—It is suggested that the so-called tubercle bacillus is really a stage in the life history of a fungus with a mycelial growth which may be designated as Tuberculomyces.

On fibrin formation in the different anatomical products of tuberculosis, WERNECK DE AQUILOR (*Arb. Path. Anat. Inst. Tübingen, 2 (1896), No. 2, p. 245; abs. in Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No. 17–18, pp. 699, 700*).

Texas cattle fever in various localities, R. R. DINWIDDIE (*Arkansas Sta. Rpt. 1896, pp. 36–40*).—A reprint from Bulletin 40 of the station (E. S. R., 8, p. 525).

Investigations of hog diseases, R. R. DINWIDDIE (*Arkansas Sta. Rpt. 1896, pp. 42–44*).—A reprint from Bulletin 40 of the station (E. S. R., 8, p. 525).

On the toxic properties of molds, R. R. DINWIDDIE (*Arkansas Sta. Rpt. 1896, pp. 35, 36*).—A reprint from Bulletin 40 of the station (E. S. R., 8, p. 524).

Check list of the animal parasites of geese, A. HASSALL (*U. S. Dept. Agr., Bureau of Animal Industry Circ. 14, pp. 5*).—This list of the parasites of *Anser anser domesticus* is taken from the card catalogue of the zoölogical laboratory of the Bureau and contains all of the species recorded up to the present time, so far as traceable by the author in veterinary and zoölogical literature. Dates and synonyms are given and the place of occurrence within the body noted.

Parasites of domestic animals, G. MCCARTHY (*North Carolina Sta. Rpt. 1896, pp. 101–142, figs. 33*).—A reprint of Bulletin 127 of the station (E. S. R., 8, p. 521).

Parasites of poultry, G. MCCARTHY (*North Carolina Sta. Rpt. 1896, pp. 265–276, figs 12*).—A reprint of Bulletin 131 of the station (E. S. R., 9, p. 96).

On the preservation of potatoes for culture purposes, M. SIMMONDS (*Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No. 3, pp. 100, 101*).

The physiology of internal secretions, W. H. HOWELL (*Science, n. ser., 6 (1897), pp. 37–49*).—The author gives a somewhat critical summary of literature relative to the functions, etc., of the thyroids, parathyroids, the suprarenals, and of the hypophysis. It is shown that excision of the thyroids is not fatal unless the parathyroids be taken along with them, and that excision of the parathyroids alone is fatal. All the glands discussed are shown to excrete internally substances of some use to the bodily economy. He notes that experiments of his own in which injections of extracts of the glands of the hypophysis were made gave reactions similar to like experiments with the suprarenals, and not, as has been given by others, similar to injections of thyroids.

Agglutination phenomena and the cholera vibrio, A. TAURELLI SALIMBEIN (*Ann. Inst. Pasteur, 11 (1897), pp. 277–286; abs. in Jour. Roy. Micros. Soc. [London], 1897, No. 3, p. 242*).—The agglutination is produced outside of the organism so far as the microbe is concerned. It is not found in the subcutaneous tissue nor in the peritoneal sac of actively or passively immunised animals. In tubes of serum and vibrios in vacuo no agglutination occurred, while in tubes exposed to the air it occurred rapidly.

Bacillus of Friedländer in tonsilitis and pharyngitis, W. C. C. PAKES (*British Med. Jour., 1897, No. 1, p. 715; abs. in Jour. Roy. Micros. Soc. [London], 1897, No. 3. p. 243*).—The pneumobacillus was found in 5 out of 500 cases of tonsilitis and pharyngitis.

Bacterium coli anindolicum and Bacterium coli anaërogenes, W. LEMBKE (*Arch. Hyg., 27 (1896), No. 4; abs. in Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No. 6–7, pp. 281, 282; Jour. Roy. Micros. Soc. [London], 1897, No. 3, pp. 243, 244*).—These were isolated from dogs' feces and in appearance and growth resemble *Bacterium coli commune*. They occur mostly in pairs. The first is motile and flagellated and the second not. In bouillon the first gives with potassium nitrate and strong sulphuric acid a red color capable of being extracted by amyl alcohol. It ferments grapes and milk sugars, producing a gas and an acid. The second does the same with the exception of producing no gas.

Biological studies in Massachusetts, II, G. C. WHIPPLE (*Amer. Nat., 31 (1897), No. 367, pp. 576–582*).—The results of the examination of some 40,000 samples of water are given. Of vegetable organisms Diatomaceæ are found in largest numbers. Following these come Cyanophyceæ and Chlorophyceæ. Infusoria about equal the

Diatomaceæ. The organisms that have been the cause of trouble in water supplies are prominently noted.

On diphtheria cultures on nonalbumenous culture media, N. USCHINSKY (*Centbl. Bakt. u. Par. 1. Abt., 21 (1897), No. 4. pp. 146, 147*).

Spirillum obermeieri and blood of relapsing fever, J. TICTIN (*Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No. 5, pp. 179–186; abs. in Jour. Roy. Micros. Soc. [London], 1897, No. 3, pp. 240, 241*).—In spirillous blood in glass vessels at room temperature the organisms degenerated and soon died. Cover glass preparations from such blood showed the presence of Spirochætæ in the white corpuscles. Since phagacytocis was not noted in blood of patients or of apes suffering from relapsing fever the author concludes that the leucocytes can successfully attack enfeebled spirilla only.

Trichorrhexis nodosa, ST. MARKUSFELD (*Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No. 6–7, pp. 230–234*).—This disease is shown to be due to a bacillus capable of being demonstrated by cultivation or by staining. The organism is endosporous and about 2 μ long by 0.5 μ broad. It lignifies gelatin and coagulates milk. An inoculation of bouillon cultures produces the disease.

The sanitation of farm buildings, J. SCOTT (*Trans. Highland and Agr. Soc. Scotland, 9 (1897), pp. 40–60, figs. 7*).—The conditions necessary for the maintenance of the health of animals in buildings is discussed under the following heads: Site and foundations, ventilation, lighting, drainage, water supply, disinfectants, and preservatives. The application in the construction of farm buildings of the various principles discussed is explained.

AGRICULTURAL ENGINEERING.

The construction of silos and the making and handling of silage, F. H. KING (*Wisconsin Sta. Bul. 59, pp. 31, figs. 14*).—This is an excellent popular bulletin on the subject, describing and illustrating the methods of building different kinds of silos, the advantages of different methods of construction, kind of lining, ventilation, the capacity of silos, the making and feeding of silage, proper degree of maturity of corn and clover for making silage, losses of dry matter in the silo, cost of silos, etc.

"The *necessary* loss of dry matter in the silo means the loss in the interior where all outside air is excluded, and which occurs in developing those conditions which arrest further fermentation until air is again admitted to the silage.

"In 1893–'94 with corn containing 35.68 per cent dry matter, when put in, the necessary loss was 4.95 per cent. In 1894–'95 with corn containing 29.55 per cent of dry matter the necessary loss was 9.38 per cent. In 1895–'96 with corn containing 25.72 per cent of dry matter the necessary loss was 12.93 per cent. In 1896–'97 we had the silage arranged in definite layers, giving several trials in one season, and with corn containing 29.33 per cent of dry matter the loss was 8.63 per cent; containing 25.39 per cent, the loss was 10.01 per cent; and when containing 20.66 per cent, the loss was 24.35 per cent. In this last case the loss is at least 4 per cent too high on account of its including the losses at the surface and around 2 doors.

"In another case where 2 small samples were made by splitting stalks, ears, and leaves into halves to get exact duplicates, one to put into the silo and the other to use in determining the dry matter put into the silo, it was found that 2 samples side by side sustained the following losses:

"Flint corn containing 35.26 per cent dry matter, lost 8.59 per cent of the amount put in.

"Dent corn containing 24.05 per cent dry matter, lost 17.22 per cent of the amount put in.

"Medium clover containing 22.08 per cent dry matter, lost 20.65 per cent of the amount put in.

"Our losses in clover silage have been, for five trials, as follows:

"Alsike clover, '95, containing 30.20 per cent dry matter, lost 10.10 per cent of the amount put in.

"Alsike clover, '96, containing 32.49 per cent dry matter, lost 15.37 per cent of the amount put in.

"Medium clover, '95, containing 30.66 per cent dry matter, lost 16.06 per cent of the amount put in.

"Medium clover, '96, containing 28.65 per cent dry matter, lost 16.61 per cent of the amount put in.

"Medium clover, '96, containing 36.59 per cent dry matter, lost 17.17 per cent of the amount put in.

"It will be seen from these trials that the necessary losses of dry matter in corn silage have been found to be from 5 per cent to 10 per cent, and for clover silage from 10 per cent to 18 per cent, provided the right degree of maturity and dryness obtains when the materials are put into the silo. . . .

"Corn well matured and in good condition for shocking but with leaves still green is the proper stage for the silo, and clover in full bloom or a trifle past and in good condition for hay but not too dry is the proper stage for this."

Some observations on the effect of silage odors on milk are noted elsewhere (p. 378).

Irrigation in humid climates, F. H. KING (*U. S. Dept. Agr., Farmers' Bul. 46, pp. 26, figs. 4*).—This bulletin discusses the following topics: The advantages of an abundant supply of soil moisture; the rainfall of the growing season in the United States is insufficient for maximum yields; water only one of the necessary plant foods; advantages and disadvantages of irrigation in humid climates; extent of irrigation in the humid parts of Europe; the rainfall of Europe and the eastern United States compared; the character and antiquity of European irrigation; fertilizing value of irrigation waters; lines along which irrigation should first develop; lands best suited to irrigation in humid climates; waters best suited to irrigation; amount of water needed for irrigation; methods of obtaining water for irrigation; the construction of reservoirs; and methods of applying irrigation water.

Pumping water for irrigation, H. M. WILSON (*Water Supply and Irrigation Papers, U. S. Geological Survey, No. 1, pp. 58, pls. 9, figs. 17*).—This is the first of a series of short reports, generally popular in character, authorized by act of Congress approved June 11, 1896, "relating to the water resources and the methods of utilizing these, with especial reference to the employment of water in agriculture. . . .

"A general description is given of pumps and motive powers, and of windmills, water wheels, and various kinds of engines, noting the more important of these." Special attention is given to hot-air, gasoline, and steam pumping engines; centrifugal and rotary pumps; and mechanical and siphon elevators; and a chapter is added on storage reservoirs.

The interesting fact is noted that in the development and improvement of methods of raising water "there is a tendency to return to the primitive forms used by the primitive agriculturists. For example, after trying all the complications of valves and pistons, of tight joints and complicated motions, designers of machinery are in some instances turning back to the old simple Persian wheel, which lifts water in buckets with the minimum of friction and of load to be raised."

Irrigation near Phœnix, Arizona, A. P. DAVIS (*Water Supply and Irrigation Papers, U. S. Geological Survey, No. 2, pp. 98, pls. 31, figs. 15*).—In view of the importance of the storage of flood waters on a large scale in connection with the development of the arid sections of the United States, this bulletin undertakes to describe the situation as regards this subject in the Salt and Gila River valleys, in which the conditions are fairly typical. The topographic and climatic conditions of these valleys and the irrigation works already constructed are described, some of the systems now being introduced are outlined, and the legal complications which have arisen are mentioned.

The author "points out the great natural advantages of this country, and shows, as far as data can be procured, the facts relating to water supply, evaporation, silting of reservoirs, and other factors which make or mar projects of water conservation."

Sewage irrigation, G. W. RAFTER (*Water Supply and Irrigation Papers, U. S. Geological Survey, No. 3, pp. 100, pls. 4, figs. 28*).—It is stated that the object of this paper is "to point out to American farmers and to municipal authorities the fact that under certain conditions sewage may be utilized with profit and to indicate in general terms how this may be done." The principal topics discussed are: Importance of sewage irrigation; general principles and definitions; quantity of sewage from different cities; stream pollution; agricultural value of sewage; methods of disposal, including chemical precipitation, intermittent filtration, and irrigation; sewage farming in England; sewage utilization in Germany and France; and sewage purification in the United States.

The author believes that purification and utilization of sewage may be successfully combined. To utilize sewage to the best advantage in agriculture, provision should be made for intermittent filtration to dispose of the sewage when not needed on crops.

The actual fertilizing value of average sewage is stated to be from 1 to 2 cts. or perhaps 3 cts. per ton. Taking into account its value for irrigation when rainfall is deficient, the total value may be taken as 2 to 4 cts. when the sewage is applied to the best advantage. Sewage farming is of especial importance in the arid and semiarid parts of the United States.

Although the system has proved very successful abroad, it has not generally been specially successful in the United States. This has been due largely to improper management. The most notable examples of sewage utilization in the United States are probably Pullman, Illinois; Los Angeles, California; South Framingham, Massachusetts; Meriden and Bristol, Connecticut, and Plainfield, New Jersey.

Motive powers on the farm, W. J. MALDEN (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 8 (1896), pp. 179–213, figs. 21*).—The relative efficiency and the practical applications of the following motive powers for farm purposes are briefly discussed: Animal power; wind engines; water power, including methods of measuring the power of a given water supply, water motors of various kinds, and hydraulic rams; steam power; gas and oil engines, and electric motors. A typical motor of each class is described and illustrated.

Results of windmill tests, E. C. MURPHY (*Kansas Univ. Quart., 6 (1897), No. 2, pp. 89–94, figs. 2*).

Farm buildings and economical agricultural appliances, W. J. MALDEN (*London: Kegan Paul, French, Trübner & Co., Ltd., 1896, pp. 192, figs. 18*).—Includes chapters on general considerations on farm buildings; homesteads adapted to varying conditions; covered yards and temporary buildings—conversion of existing buildings to suit changes; farm cottages and water; machinery for farm buildings—power; and machinery for special purposes. This well-written book is designed especially for the British farmer, but many of its suggestions are of wider interest and application.

Ready-reference book for the agricultural engineer, V. VERMOREL (*Aide-mémoire de l'ingénieur agricole. Paris: Librarie polytechnique Baudry & Cie., 1897, pp. 1000, figs. 140*).—A very handy and complete collection of useful tables, formulas, methods, etc., relating to mathematics, mechanics, physics, agricultural chemistry, geology, botany, zoölogy, meteorology, agriculture, viticulture, arboriculture, parasites and diseases of cultivated plants, agricultural technology, agricultural engineering, zoötechny, rural law, and miscellaneous topics. The book also contains a classified list of the principal works consulted in its preparation and an alphabetical index.

STATISTICS.

Ninth Annual Report of Alabama College Station, 1896 (*Alabama College Sta. Rpt. 1896, pp. 30*).—The work of the year is reviewed in outline by the heads of departments and a financial statement given for the fiscal year ending June 30, 1896.

Seventh Annual Report of Arizona Station, 1896 (*Arizona Sta. Bul. 24, pp. 10*).—A financial statement is given for the fiscal year ending June 30, 1896, with lists of bulletins published by the station since its organization, acknowledgments and exchanges, and a report by the director giving the results of the year's work.

Report of the director of Arkansas Station for 1896 (*Arkansas Sta. Rpt. 1896, pp. 1, 2*).—Brief report by the director on the work of the year and a financial statement for the fiscal year ending June 30, 1896.

Ninth Annual Report of Illinois Station, 1896 (*Illinois Sta. Rpt. 1896, pp. 16*).—A general account of station work, showing experiments in hand during the year, new work authorized, bulletins published, and a detailed financial statement for the fiscal year ending June 30, 1896.

Ninth Annual Report of Indiana Station, 1896 (*Indiana Sta. Rpt. 1896, pp. 61*).—Reports by the director and heads of departments, parts of which appear elsewhere, together with plans of various station buildings, lists of acknowledgments and of bulletins issued, and a financial statement for the fiscal year ending June 30, 1896.

Report of the director of Massachusetts Hatch Station for 1896 (*Massachusetts Hatch Sta. Rpt. 1896, pp. 18*).—Brief remarks on the consolidation of the Massachusetts State Station with the Hatch Station and on the enlargement of the scope of the work in the different departments; station personnel; subject list of bulletins issued from 1887 to 1897, and a financial statement for the fiscal year ending June 30, 1896.

Third Annual Report of Montana Station, 1896 (*Montana Sta. Bul. 12, pp. 61–96*).—Brief report by the director on the station staff, farm buildings and equipment, acreage and yield of farm crops at the station and in Gallatin County in 1895, press exchange list, and lists of donations to the station; reports by the chemist and by the horticulturist, elsewhere noted; and a financial statement for the fiscal year ending June 30, 1896.

The work during 1896 of the North Carolina Experiment Station (*North Carolina Sta. Rpt. 1896, pp. LXXXVIII, 364*).—This embraces reports by the director and heads of the departments on the work of the year; lists of the station publications; acknowledgments; legislation relative to crop diseases; opinions of nearly 1,000 North Carolina farmers, representing 95 counties, in regard to the work of the station; reprints of station Bulletins Nos. 124 to 133, and a financial statement for the fiscal year ending June 30, 1896.

Ninth Biennial Report of the director of the North Carolina Station for the two years ending January, 1897 (*North Carolina Sta. Biennial Rpt. 1895 and 1896, pp. 157*).—Reprinted from the Annual Reports of the Station for 1895 (E. S. R., 8, p. 937) and 1896. (See above.)

Annual Report of Oklahoma Station for 1897 (*Oklahoma Sta. Rpt. 1897, pp. 11*).—A report by the director on the station personnel and work of the year, with a list of the bulletins published since the organization of the station, and a financial statement for the fiscal year ending June 30, 1897.

Ninth Annual Report of Texas Station, 1896 (*Texas Sta. Rpt. 1896, pp. 912–926*).—This consists of a report by the director on the work of the station and substations; brief reports by the heads of departments, parts of which appear elsewhere; a list of trees, plants, and vines growing at the home station; and a financial statement for the fiscal year ending June 30, 1896.

Crop report for August, 1897, J. HYDE (*U. S. Dept. Agr., Division of Statistics Rpt. 151, n. ser., pp. 7*).—The usual summary of crop conditions in this and other countries.

Edinburgh corn-market grain tables for wheat, barley, oats, and beans (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 9 (1897), pp. 386–392*).—The tables show the quantity of grain offered for sale and the quantity sold. The highest, lowest, and average prices received for each kind of grain on every market day, the results for every month, and the final results for the year 1896 are given.

Our trade with Cuba from 1887 to 1897, F. H. HITCHCOCK (*U. S. Dept. Agr., Section of Foreign Markets Circ. 16, pp. 30*).—This gives the quantity and value of the merchandise imported and exported by the United States in our trade with Cuba during the fiscal years 1887 to 1896, inclusive, and the 9 months ended March 31, 1897.

Hawaiian commerce from 1887 to 1897, F. H. HITCHCOCK (*U. S. Dept. Agr., Section of Foreign Markets Circ. 18, pp. 37*).—Statistics relative to the exports and imports of the Hawaiian Islands from 1887 to 1897, with further detailed data showing the nature and extent of the commercial transactions with the United States during the same period. Over 91 per cent of the total foreign commerce of Hawaii is with the United States, and of the exports alone more than 99 per cent is sent to this country. Sugar constitutes 94 per cent of the export trade.

Exports of cotton from Egypt, F. H. HITCHCOCK (*U. S. Dept. Agr., Section of Foreign Markets Circ. 15, pp. 7*).—Reprinted from Office of Experiment Stations Bulletin 42 (E. S. R., 9, p. 297).

Russia's cotton industries, J. C. MONAGHAN (*United States Consular Rpts. 55 (1897), No. 204, pp. 76, 77*).

Danish agricultural exports and imports during 1895 (*Ugeskr. Landm., 42 (1896), pp. 637–639*).

United States wheat for Eastern Asia, F. H. HITCHCOCK (*U. S. Dept. Agr., Section of Foreign Markets Circ. 17, pp. 8*).—Statistics are given showing the quantity and value of wheat, wheat flour, and breadstuffs exported from the United States to Japan, China, and Hongkong for the years 1887 to 1896, inclusive, with a discussion on the probable future increase in the consumption of these materials throughout the East.

Wheat harvest of Germany and Hungary, F. H. MASON (*United States Consular

Rpts. 55 (1897), No. 204, pp. 118, 119).—A report on the crop of 1897. The world's wheat supply for the year is considered.

The harvest in Denmark during the last decennium, J. WINKLE (*Tidsskr. Landökon., 15 (1896), pp. 594–613*).

Sugar production in Russia during the campaign of 1895–'96 (*Mitt. deut. landw. Gesell., 12 (1897), No. 15, Suppl., p. 83*).—A table.

Report of chemical section and seed control station at Jönköping for 1895, C. VON FEILITZEN (*Redogörelser för arbetena vid Frökontrol-Anstalten och Kemiska Stationen i Jönköpings Län, år 1895. Jönköping, 1896, pp. 69*).

Report of the chemical control station in Christiania, Norway, for 1895, F. H. WERENSKIOLD (*Rpt. Dept. Agr. Norway, 1895, pp. 88–137*).—Gives the usual account of the routine work of the year; also analyses of 47 samples of Norwegian root crops.

Report for 1895 published by the Royal Swedish Agricultural Department, (*Berättelser för år 1895 of Kongl. Landtbruksstyrelsen, No. 33. Stockholm, 1896, pp. 330*).

Idaho agriculture, descriptive and experimental, C. P. FOX (*Idaho Sta. Bul. 10, pp. 5–29*).—Statistics of the State and counties.

Farms in Norway January 1, 1891, and their value, 1886-'90, A. N. KIAER (*Norway's Official Statistics, 3. ser., No. 244. Christiania, 1896*).—With table of contents in French.

Michigan State farmers' institutes, winter of 1896-'97 (*Michigan State Bd. Agr. Institute Bul. 3, pp. 184*).—This includes the full text or abstracts of papers read and discussions carried on at the different farmers' institutes conducted by the State Board of Agriculture during the winter of 1896–'97, with a discussion of some of the chief features of the work and the addition of some statistical data. Farmers' institutes were held at 68 different points in Michigan during the year. The attendance varied from 43 to 596, the total attendance at all institutes being about 13,100.

Proceedings of the Eure society of agriculture, science, and belles-lettres (*Recueil des travaux de la Société libre d'agriculture, sciences et belles-lettres de l'Eure, 5. ser., 4 (1896), pp. 267*).

Report of Ultuna Agricultural Institute for 1895 (*Redogörelse för Verksamheten vid Ultuna Landtbruksinstitut under år 1895. Falun (Sweden), 1896, pp. 133*).

Lyngby Agricultural School, Denmark (*Ugeskr. Landm., 41 (1896), pp. 403–406*).

Tune Agricultural School (*Ugeskr. Landm., 41 (1886), pp. 453–456*).

Ladelund Agricultural School (*Ugeskr. Landm., 41 (1896), pp. 479–484*).

Malling Agricultural School, Denmark (*Ugeskr. Landm., 42 (1896), pp. 555–557*).

Dalum Agricultural School, Denmark (*Ugeskr. Landm., 42 (1896), pp. 543–545*).

NOTES.

ARIZONA UNIVERSITY AND STATION.—W. S. Devol has resigned his position as professor of agriculture and horticulture in the university and director, agriculturist, and horticulturist of the station; and J. W. Toumey, botanist and entomologist of the station, has been chosen acting director. N. H. Barnes has been appointed irrigation engineer and meteorologist of the station *vice* E. M. Boggs, who has been granted leave of absence for 1 year. B. Eager has been made foreman of the Phœnix Station *vice* N. H. Claflin; and Wm. V. Whitmore, of Tucson, has been appointed a member of the board of regents *vice* M. G. Samaniego, resigned.

The experiments in date culture at the station are being supplemented by a study of the conditions of date culture throughout the Territory. It is found that dates thrive and bear bountifully in the southern part of Arizona and the outlook for date culture in Arizona is believed to be very encouraging.

CALIFORNIA UNIVERSITY AND STATION.—J. B. Davy has been appointed assistant botanist of the station.

The building of the college and station which was destroyed by fire last April, involving a loss of about $15,000, $6,000 of which was in apparatus, etc., has been replaced by a larger and better one, and the work in the laboratories and various departments has been resumed.

CONNECTICUT STATE STATION.—Late in August the tobacco-curing barn at Poquonock used by the station for experimental work was destroyed by fire. The barn was full of tobacco, partly cured, which represented the year's experimental work with fertilizers. The financial loss amounts to about $1,200.

MISSOURI STATION.—T. I. Mairs, formerly assistant at the Illinois Station, has been appointed assistant in agriculture *vice* D. W. May, resigned; and C. H. Thompson, assistant in botany, has been succeeded by M. C. Thorne.

NEW YORK CORNELL STATION.—C. W. Sims, G. A. Smith, and H. B. Cannon are no longer connected with the station.

NORTH DAKOTA COLLEGE AND STATION.—W. G. Langdon has been elected veterinarian of the college and station *vice* T. D. Hinebauch, resigned.

PENNSYLVANIA COLLEGE AND STATION.—William Frear, Geo. C. Butz, Enos H. Hess, and J. A. Fries have been detailed to represent the school of agriculture and the experiment station at the farmers' institutes to be held throughout the State the coming winter under the direction of the State Department of Agriculture. In order to render possible the above detail of instructors the commencement of the short winter course in agriculture has been postponed from January 5 to March 2. The creamery course will be given as heretofore, beginning January 5, and there has been added a 6-weeks' course in cheese making, extending from February 16 to March 30.

NECROLOGY.—Prof. Friedrich Stohmann, widely known for his investigations in agricultural chemistry, and especially with the bomb calorimeter, died at Leipsic, November 1, 1897, at the age of 65 years. Professor Stohmann was one of the earlier assistants to Professor Henneberg, and was associated with him in his investigations on animal nutrition at the Weende experiment station. In 1862 he organized the experiment station at Brunswick, one of the older German stations. Later he was professor in the University of Halle, and in 1871 was called to Leipsic as director of the agricultural-physiological institute of the university. In 1887 he also assumed charge of the agricultural-chemical institute at the same place. Professor Stohmann had been associated with agricultural investigation since 1857, and had made numerous contributions, especially on the nutrition of plants and animals. Of late years he had devoted his attention largely to calorimetric investigation of the constituents of foods and feeding stuffs, in which field he had been for some time a recognized authority.

A NEW IRRIGATION JOURNAL.—The first number of the Irrigation Review (pp. 52, figs. 12), edited by D. W. Working and published at Denver, Colorado, by the Irrigation Publishing Company, bears date of September, 1897. It is stated that "the new journal will be devoted to the development of irrigation in its larger and broader phases. Its field will be the discussion of all the problems incident to irrigation, such, for example, as the practical, legal, scientific, and economic questions that arise by reason of the practice and development of irrigation as an exceedingly necessary and profitable part of the great agricultural industry."

The first number contains, besides editorial and miscellaneous notes, articles on The cession of the arid lands, by J. S. Greene; Water—the queen of beauty and harvest, by Alva Adams; The financial side of irrigation, by J. E. Leet; The National Irrigation Congress; Problems confronting the settler on the plains, by J. E. Payne; The experiment stations at work; Irrigation in humid climates (which is a summary of Farmers' Bulletin 46 of this Department); The increasing importance of irrigation, by W. M. Hays; and The construction of irrigation reservoirs, by E. B. Cowgill.

EXPERIMENT STATION RECORD.

VOL. IX. NO. 5.

The report[1] of the commission appointed to investigate the agricultural and horticultural possibilities of Alaska contains much of general interest concerning the present agricultural conditions of that country and the possibilities of agricultural development. This commission, consisting of Hon. Benton Killin, a regent of the Oregon Agricultural College and Experiment Station, and Dr. Walter H. Evans, of this Office, spent the past summer in Alaska, visiting the southern coast region from Dixon Entrance on the southeast to Unalaska on the southwest. Including side trips the distance covered exceeded 3,500 miles of travel by boat.

Much of the region visited is very mountainous, although there are many narrow valleys and tide flats of considerable extent. The southern coast region is naturally divided by the St. Elias and Fairweather mountains into two very characteristic regions. The southeastern portion of the country is heavily wooded, trees extending from tide water up the mountain sides 2,000 ft. or more. The most common and widely distributed forest tree is the Sitkan spruce (*Picea sitchensis*). In some places trees of this species of great size were seen. Spruce logs approximating 100 ft. in length and 4 or 5 ft. in diameter are not uncommonly seen about the few sawmills in the Territory. Other valuable trees occur in considerable quantity, such as the red and yellow Alaskan cedars (*Thuja gigantea* and *Chamæcyparis nootkatensis*), the hemlocks and alders, with the birches and cottonwoods occurring rather abundantly in some localities.

The southwestern region, from Cook Inlet to Unalaska, is characterized by its wealth of grasses. *Poa pratensis*, *Deschampsia cæspitosa*, *D. bottnica*, *Calamagrostis aleutica*, and *Hordeum boreale* are common species everywhere, while in the southeastern portion common timothy and orchard grass do exceedingly well. Nor are these the only fodder plants. White clover is spreading everywhere; red clover has apparently not been given a thorough trial, although the scattered plants seen were growing vigorously, and a native vetch is abundant in pasture lands and is said to be readily eaten by stock.

But little has been attempted with cereals so far as could be learned. Scattered plants of oats, barley, and rye were seen that were headed

[1] 55th Congress, 2d session, House Doc. No. 160.

on the last day of July. Wheat was matured at Sitka in 1896 and flax was in full bloom at the same place the first of September this year. Buckwheat is said to have been grown in the Cook Inlet region, although none was seen.

Nearly every village has a number of gardens in which, in spite of very indifferent cultivation between planting and harvest, potatoes, turnips, ruta-bagas, cabbages, cauliflowers, peas, carrots, radishes, lettuce, onions, etc., are grown. Specimens from Kadiak of what are supposed to be Beauty of Hebron potatoes weighing more than 1 lb. each are now in this Office. Celery of excellent quality was grown at the same place the past season.

Some form of bedding the soil is practiced nearly everywhere, but the greatest evil is the tendency to crowding through planting too closely. Close planting seems nearly always the rule, and it results in such a complete shading of the ground that the sun's rays rarely or never strike the soil. Poor drainage is often an accompaniment of close planting, and with the rank growth of weeds it is no wonder that meager results are secured.

Alaska is preeminently a berry country. Wild strawberries, currants, raspberries, salmon berries, blueberries, huckleberries, and cranberries abound, and in addition there are numerous others of more local distribution. But little attempt has been made to domesticate any of them, although some strawberries, raspberries, and currants were seen in a few gardens. A few plum trees have been planted, but they have not yet produced fruit. No attempt seems to have been made to graft any of the more hardy apples upon the native wild crab, although the latter is abundant throughout southeastern Alaska.

The live stock industry is represented by a few horses, milch cows, beef cattle, pigs, chickens, and one small flock of sheep. On account of the limited supply of winter forage stock is generally in very poor condition in the spring, but a few weeks' grazing upon the abundant and nutritious grasses puts the animals in good flesh.

A limited quantity of hay is made at various places, but the generally cloudy weather is thought to be very unfavorable to haymaking. With more care in cutting and handling the grass a much greater amount of hay could be made, and if the methods of Iceland and some other portions of Europe or those said to be adopted by the Hudson Bay Company were followed all the hay necessary could probably be made. In a few instances silos have been rather successfully employed, but as most of them were poorly constructed and not properly filled with grass, complaints were heard that the silage was so badly molded that stock would not eat it. Under proper conditions of ensiling this could probably be avoided.

The climate of the coast region of southern Alaska, as shown by records kept by the Russians as well as by observers of the Weather Bureau of this Department, is a very moist but not cold one. Zero weather is of short duration and —10° F. is seldom experienced. In the summer 75 to 80° is about the maximum. With such a temperature, plenty of moisture, and days of 20 hours or more of daylight it is not strange that the vegetation makes such rank growth.

The report also contains a brief preliminary report of Dr. Sheldon Jackson, of the Bureau of Education, on the agriculture of the Yukon Valley, based upon his tour of that region the past season. Flourishing gardens were seen at Koserefski and Anvik, 335 and 355 miles, respectively, from the mouth of the Yukon. Potatoes weighing more than a pound each and turnips weighing 10 lbs. each were seen at these places. At Circle City and Fort Cudahy good gardens are maintained by the commercial companies. Peas, beans, beets, radishes, lettuce, and cabbage are grown at the two latter places. A vegetable garden has been established at Dawson, and a few miles below Circle City 3,000 pounds of turnips were grown last year. Grasses and berries abound in the Yukon Valley as in the coast regions.

Whether agriculture will flourish in Alaska as it has in the high latitudes of Europe only experimentation can determine, but it seems probable that with proper direction the local demands for many products could be fully supplied.

CONVENTION OF ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS, 1897.

W. H. Beal,

Office of Experiment Stations.

The fourteenth annual convention of the Association of Official Agricultural Chemists was held in the lecture hall of the Columbian University at Washington, D. C., October 26–28, W. Frear presiding. About 60 members were in attendance.

The annual address of the president, W. Frear, was devoted to a brief review of the origin, history, and work of the Association, with suggestions as to the direction which this work should take.

"Primarily, the work of the Association has been chiefly along the lines of importance to the official chemist. This must still be, to a large extent, true of the Association's work. But it will fail of its high opportunities and choose an ideal lower than it may properly select, if its work be not pushed also, in a large measure, along more distinctly scientific lines. . . .

"The work in determination of available plant food in soils, the study of the methods of analysis applicable to slag phosphates, the test of various methods for the separation and determination of simple substances and narrower, better defined groups of substances, in cattle foods and dairy products, the studies of solubilities of various phosphates, may be cited as illustrations of valuable work by the Association in this field. If we would accomplish most, we must remember that the ideal accomplishment is not the perfection of an arbitrary method for the determination of an ill-defined group of substances, but, much further on, the attainment of a method by which such a group may be resolved into its simple components, and the effective value of each determined."

Special emphasis was laid upon the importance of the food supply question. The enormous production and consumption of foods in the United States and the extent of their adulteration were cited as arguments in favor of a food control with uniform laws and methods throughout the country.

Statistics indicate that fully one-third of the income of the American people is expended for food, food accessories, and beverages and that from 5 to 15 per cent of the entire food supply upon our market is adulterated, at least 10 per cent of the adulteration being injurious to health. It is, therefore, fully as imperative that analytical methods for the detection of adulteration should be applied to foods as to fertilizers and other agricultural products.

Two ways in which the Association may assist food control chemists are suggested, (1) "by the careful selection, accurate description, and test of methods fitted for the control examination of various classes of adulterable food materials upon the market . . . (2) by taking steps to secure the establishment of standards of composition for pure food substances."

A committee consisting of A. L. Winton and B. W. Kilgore was appointed to wait upon the Secretary of Agriculture and invite him to attend the meetings of the Association. The Secretary accepted the invitation and made a short address, commending the work of the Association and citing a number of illustrations of the benefits which practical agriculture has derived from chemical investigation.

The usual committee on recommendations of reporters was appointed as follows: J. M. Bartlett, H. J. Wheeler, M. A. Scovell, L. L. Van Slyke, and B. H. Hite.

FERTILIZERS.

Phosphoric acid.—The report on phosphoric acid was presented by H. B. McDonnell. The subjects of investigation during the past year treated in this report were (1) comparative tests by 19 analysts of the official molybdic method, the Pemberton[1] volumetric method as modified by Kilgore[2] and McDonnell[3] (the reporter) and Gladding's[4] method on South Carolina and Florida rock phosphates, aluminum phosphate, Pottstown slag, and cotton-seed meal; (2) comparative determinations by 4 analysts of iron and aluminum in South Carolina and Florida phosphates, slag, and a mixture of 1 part of ferrous ammonium alum, 1 of aluminum sulphate, and 2 of tricalcium phosphate, by the acetate, thiosulphate, and Glaser methods (the Gladding[5] potash method was incidentally tested on mixtures of known composition): (3) tests of solubility of the phosphoric acid of slag (*a*) by the official method (digesting for ½ and 1 hour), (*b*) in 1 per cent citric acid (digesting 1 gm. in 100 cc. of acid at 20° C. for 1 and 2 hours), and (*c*) by the Wagner method; (4) fineness of slag as determined by passing 10 gm. through a brass sieve with circular holes ½ mm. in diameter and bolting cloth with 4 and 5 meshes per millimeter; and (5) the determination of the amount of slag removed by a magnet.

The official method in its present form appeared to give entirely satisfactory results; but the results by the volumetric method were not

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[1] Jour. Amer. Chem. Soc., 15 (1893), p. 382.

[2] U. S. Dept. Agr., Division of Chemistry Bul. 46, p. 13. Jour. Amer. Chem. Soc., 16 (1894), p. 765; 17 (1895), p. 950; 19 (1897), p. 703. North Carolina Sta. Bul. 140.

[3] McDonnell's method is as follows: To an aliquot portion of the solution prepared according to one of the official methods is added NH_4OH in excess, then HNO_3 in excess, then the regular molybdate solution (which should be filtered if necessary) in excess. Warm on the water bath to about 50° C. for 20 or 30 minutes, with occasional stirring, filter, wash with water at ordinary temperature until filtrate fails to show acidity when tested with litmus paper. Transfer the filter and contents to a beaker, add 20 to 40 cc. of water and standard alkali sufficient to dissolve, stirring well, titrate excess of alkali with standard sulphuric or nitric acid, using phenolphthalein as indicator.

[4] Jour. Amer. Chem. Soc., 18 (1896), p. 23.

[5] Ibid., p. 721.

entirely satisfactory in the hands of all the analysts, especially on substances containing high percentages of phosphoric acid. For this reason the convention directed that the method should be further tested.

The results of the tests of the official method of determining citrate-soluble phosphoric acid were somewhat discordant, as well as those with citric acid. The Wagner method gave very good results, considering the widely different methods of manipulation.

The methods of examining slags were discussed at some length. In this connection H. W. Wiley pointed out the need of an official method for slag, which is likely to become an important fertilizer in American markets, and called attention to the importance of the degree of fineness of the slag. He recommended the Wagner method for use provisionally.

H. A. Huston stated that investigations which he had made led him to believe that all phosphoric acid in slag is in the tetra-basic form, and if so it is all available. In his opinion the degree of fineness and the total phosphoric acid make a safer basis of valuation than citrate solubility, since the latter varies so greatly with slight variation in the proportion of solvent to substance, temperature, etc. He recommended that the complete analysis of slag be studied by the Association.

The Association directed that the methods of analysis of slag be studied by the reporter on phosphoric acid during the ensuing year and that the Wagner method be printed in the proceedings.

The results of the tests of methods of determining iron and alumina do not admit of the drawing of any very definite conclusions. In all the tests made with it the permanganate method was very satisfactory for the determination of iron. The subject was referred to the reporter for next year.

Nitrogen.—The work of the Association during the year on methods for nitrogen, as reported by J. P. Street, included (1) comparative tests by 11 analysts of the Ulsch-Street,[1] Schulze-Tiemann,[2] Kjeldahl,[3] Gunning,[3] Ulsch-Kjeldahl,[4] and Ulsch-Gunning[5] methods on nitrate of soda containing 16.25 per cent of nitric nitrogen, a mixture of nitrate of soda, cotton-seed meal, acid phosphate, and muriate of potash containing total nitrogen 3.71 per cent, nitric nitrogen 1.63 per cent, and a mixture of nitrate of soda and Lobos guano containing total nitrogen 4.56 per cent, nitric nitrogen 1.66 per cent; and (2) comparative tests by 7 analysts of the solubility of the nitrogen of dried blood, cotton-

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[1] U. S. Dept. Agr., Division of Chemistry Bul. 46, p. 21.

[2] Fresenius' Quantitative Analysis 1886, p. 473, using 7 to 10 gm. magnesium oxid.

[3] U. S. Dept. Agr., Division of Chemistry Bul. 46, pp. 17, 18.

[4] The so-called Fassbänder method, substantially as originally described by von Schenke in Chem. Ztg., 17 (1893), p. 977; U. S. Dept. Agr., Division of Chemistry Bul. 49, p. 16.

[5] Reducing as in the Ulsch-Kjeldahl method, and then proceeding as in the Gunning method

seed meal, dried fish, tankage, hoof meal, raw leather, wool waste, bone sawings, and steamed and raw bone in pepsin solution[1] and in acid and alkaline potassium permanganate solution.[2]

The results by the Ulsch-Street method for nitrates were good, agreeing very closely with those obtained with the Schulze-Tiemann method, but the Kjeldahl method for nitrates did not give entirely satisfactory results. The Ulsch-Kjeldahl and Ulsch-Gunning method seemed to be fully as satisfactory as the Kjeldahl method on the mixed samples. but it is believed that they may be further improved.

E. E. Ewell reported that the Schulze-Tiemann method had proved very satisfactory in his experience, and he described some improved pieces of apparatus for use in this method. A. L. Winton stated that he had found the Ulsch-Gunning method satisfactory with fertilizers having a low percentage of nitrates, but that it was necessary to use a larger amount—3 gm. as a rule—of iron than is recommended in the present method.

The Ulsch-Street method for nitrates was made an official method, and the reporter was instructed to study further the Ulsch-Kjeldahl and Ulsch-Gunning methods for total nitrogen in presence of nitrates.

The pepsin and permanganate methods for determining availability of nitrogen gave discordant results in the hands of different analysts, this being especially true with the permanganate methods.

J. B. Lindsey and A. L. Winton discussed briefly the methods of determining available nitrogen in fertilizers, and advocated digestion in pepsin solution as preferable to the permanganate method.

The reporter was instructed to make a more thorough study of these methods during the coming year, including, in addition, tests of a 3 per cent neutral permanganate solution. The method proposed for the latter purpose is as follows: Digest 1 gm. of substance in 100 cc. of neutral 3 per cent potassium permanganate in a steam bath for 30 minutes, shaking occasionally; add 700 cc. of cold water, filter, wash 3 or 4 times, using in the aggregate from 125 to 150 cc. of water; determine nitrogen in the residue by the Kjeldahl method.

Potash.—The report of A. L. Winton on methods of determining potash was devoted to the results of comparative tests by 7 analysts of (1) the Stassfurt method,[3] (2) the optional method, acidulating with hydrochloric acid before precipitating sulphuric acid; (3) the Lindo-Gladding method, without removal of lime, as well as (4) an inquiry into the possibility of reducing the amount of platinum chlorid used.

"The materials [used] . . . consisted of pure potassium chlorid, pure potassium sulphate, and mixtures representing the impurities in each of the four manure salts commonly sold in the United States. The 'impurities' were distributed in vials in

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[1] Connecticut State Sta. Rpt. 1893, p. 219.

[2] U. S. Dept. Agr., Division of Chemistry Bul. 49, p. 24.

[3] This is essentially a modification of the "short method" of Fresenius. See Ztschr. angew. Chem., 1895, p. 510.

quantities corresponding to 10 gm. of the commercial salts of average composition. The total contents of each vial was boiled by each analyst with water made up to a definite volume and filtered. By mixing, in the proper proportions, aliquots of this solution with weighed portions of pure potash salts, solutions for analysis were obtained which represented definite quantities of the commercial salts."

The Stassfurt method gave good results in almost every case, and is considered thoroughly reliable by the reporter; but it does not appear to possess any advantage over the Lindo-Gladding method in accuracy, and is believed to be more time-consuming, although there was difference of opinion on this point.

No advantage was gained by acidulating with hydrochloric acid before precipitation of sulphuric acid, in the optional method.

The Lindo-Gladding method without removal of lime gave fully as accurate results as the present official method. It was shown that even when lime was present to the extent of 25 per cent it did not interfere with the determination of potash. The Association therefore adopted this modification of the method for the determination of potash in kainit as in pure salts.

The optional method is retained with the caution that it is not recommended for use when soluble sulphates are present.

The consensus of opinion seemed to be that less than 10 cc. of platinum chlorid may be safely used in the large majority of analyses, but no action was taken on this point.

The reporter for the ensuing year was instructed to study methods for determining potash in ashes and chlorin in fertilizers.

In accordance with the instructions of the previous convention, A. L. Winton submitted a reply to the criticisms by German chemists of the Lindo-Gladding method. This was ordered to be printed in the proceedings, and also published in some prominent scientific journal.

A committee of 5, consisting of H. W. Wiley, B. W. Kilgore, H. A. Huston, H. B. McDonnell, and B. B. Ross, was appointed to cooperate with a similar committee of the Association of American Agricultural Colleges and Experiment Stations in securing uniform legislation and methods relating to the inspection of fertilizers.

SOILS AND ASH.

The report on methods of analysis of soils and ash prepared by A. Goss was read by H. W. Wiley. Ten chemists participated in the work, which included determinations (1) of total phosphoric acid by Goss's method[1] and by digestion for 5 hours in strong nitric acid; (2) of phosphoric acid soluble in $\frac{1}{5}$ normal hydrochloric[2] and nitric acids; (3) total potash by Smith's[3] method, and by the hydrofluoric acid method; (4) potash soluble in $\frac{1}{5}$ normal hydrochloric and nitric acids

[1] U. S. Dept. Agr., Division of Chemistry Circ. 2.

[2] U. S. Dept. Agr., Division of Chemistry Bul. 49, p. 88.

[3] Crooke's Select Methods, 2 ed., p. 28; 3 ed., p 26.

and calcium and ammonium chlorids;[1] (5) humus and humus nitrogen and, (6) incidentally, moisture and acidity. Four samples of soil of known history were used, 2 from Rothamsted and 2 from Pennsylvania Station. One soil from each place had been treated for a number of years with phosphatic fertilizers, while one had been cropped without application of such fertilizers.

Complete analyses by 4 chemists of the ash of fornilla wood (*Prosopis pubescens*) are also reported.

The results by the $\frac{1}{5}$ normal hydrochloric acid method agreed with the known facts regarding the soils, but exaggerated the difference between the phosphoric acid contents of the two Rothamsted soils. While the ratio of the phosphoric acid content of the soil cropped without phosphate to that of the soil receiving phosphatic fertilizers, as calculated from the known history of the system of manuring and cropping pursued, was 1:1.7, the treatment with $\frac{1}{5}$ normal acid showed a ratio of 1:11.7.

The reporter for next year was instructed to make a further study of the methods of digesting soil in calcium and ammonium chlorids and $\frac{1}{5}$ normal hydrochloric acid. A committee consisting of M. A. Scovell, A. M. Peter, and H. W. Wiley was appointed to revise the phraseology of methods for soils and ash along the lines suggested by the reporter.

H. J. Wheeler briefly reported the results of a study of the relation between lime and humus in soil. He pointed out that the official methods for examining soils furnish no indication of the real need of lime in soils. Free and total humus were greatest in soils needing lime.

H. A. Huston suggested that the digestion of soils in alkaline solutions should be studied.

The secretary presented a paper by E. W. Hilgard on the aims and objects of soil analysis. In this paper the author insisted that nitrogen, phosphoric acid, and potash are not the only elements which should be determined in analysis of soils. It is fully as important to determine lime, ferrous salts, soluble silica, etc. He recommends the use of dilute hydrochloric acid for determining available potash and phosphoric acid.

FOODS AND FEEDING STUFFS.

A report on this subject, presented by J. B. Lindsey, was devoted to the following subjects: (1) A comparison by 7 analysts of the diastase,[2] Maercker,[2] and salicylic acid (or modified Baudry[3]) methods of deter-

[1] U. S. Dept. Agr., Division of Chemistry Bul. 49, pp. 88, 91.

[2] U. S. Dept. Agr., Division of Chemistry Bul. 49, pp. 47, 48.

[3] Jahresber. Agr. Chem., 1892, p. 664. The modification used was as follows: Free 3 to 5 gm. of the substance from fat and water-soluble material. Bring the dried and pulverized residue into a beaker with 200 cc. of water in which is dissolved $\frac{1}{2}$ gm. salicylic acid, and heat the beaker in a boiling-water bath, with constant stirring until the starch is rendered soluble (10 to 15 minutes). Now filter quickly through linen, using suction, wash with hot water to a volume of 200 cc. Add 20 cc. of 25 per cent hydrochloric acid and proceed as usual.

mining starch in corn meal, lupine seed, and wheat middlings; (2) the amounts of pentosans and galactans[1] in different feeding stuffs; and (3) a comparison of the phenylhydrazin and phloroglucin methods for determining pentosans.

The reporter also tested the method proposed by Wiley for the determination of starch in comparison with the methods noted above. This method is as follows: Extract the fat from 3 gm. of material, dry the residue, and digest for 2½ hours at 3½ atmospheres in an autoclave with ½ gm. salicylic acid dissolved in 50 cc. of water. After cooling make up to 250 cc., filter, and heat 200 cc. of the filtrate in a 500 cc. flask with 15 cc. of hydrochloric acid (sp. gr. 1.125) for 2½ hours at 100° C. Neutralize exactly with sodium carbonate, cool, make up to 500 cc., and determine dextrose in 25 cc. by Allihn's method.

Both the Märcker and Wiley methods gave higher results than the diastase method. The salicylic acid method gave lower results on corn meal, the same on wheat middlings, and higher on lupine seed. Examination of the residue left after treatment by the different methods indicated that the high results were due to the conversion of the pentosans and galactans. The amount of the latter present, therefore, has an important influence on the accuracy of pressure methods of determining starch. The results of tests for pentosans and galactans in a large number of feeding stuffs and farm products show that the latter are not so widely distributed nor present in such large amounts as the former.

The difference between the nitrogen-free extract as usually determined and the sum of the actual determinations of the different carbohydrates (using the diastase method for starch) was 8.74 per cent in case of corn meal, 15.82 per cent in case of middlings, and 10.74 per cent in case of lupine seed.

The phloroglucin and phenylhydrazin methods[2] were compared by 5 chemists on the 3 substances named above. The former gave somewhat higher results as a rule.

This report was discussed by H. W. Wiley, A. L. Winton, and others, H. W. Wiley especially pointing out some sources of error in the diastase method.

B. W. Kilgore called attention to a study which he has undertaken of methods of determining fat in dry and green fodders.

J. L. Hills described briefly the mill used at the Vermont Station for preparing samples of feeding stuffs for analysis.

The diastase method was adopted for all substances except commercial starches, but in carrying out the method the solution obtained by treatment with diastase is to be heated with acid for 2½ hours instead of

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[1] U. S. Dept. Agr., Division of Chemistry Bul. 49, pp. 49, 51; Massachusetts Hatch Sta. Rpt. 1896, p. 92 (E. S. R., 9, p. 372).

[2] U. S. Dept. Agr., Division of Chemistry Bul. 49, pp. 49, 53. Massachusetts Hatch Sta. Rpt. 1896, p. 97 (E. S. R., 9, p. 322).

3 hours. The phloroglucin method for determining substances which yield furfurol and the reporter's method for galactans were made provisional. The reporter was instructed to test the necessity of a second treatment with diastase in the diastase method for starch. A revision and rearrangement of methods for feeding stuffs was ordered.

The report of the committee on food legislation was read by H. W. Wiley. This report recommended national pure-food legislation along lines similar to those of the Paddock bill. The report of the committee was approved, and the committee was continued with instructions to bring the matter to the attention of Congress. This committee is H. W. Wiley, H. A. Huston, J. A. Myers, and A. S. Mitchell.

DAIRY PRODUCTS.

The report of L. L. Van Slyke on dairy products was devoted primarily to the results of comparative tests by 10 analysts of the provisional[1] and magnesium-sulphate methods for casein, and a modification of the provisional method[1] for albumin in milk. The last two methods are as follows:

Magnesium-sulphate method.—To 5 gm. of milk are added 50 cc. saturated solution of magnesium sulphate and this is heated to 40 to 45° C. to precipitate casein. The precipitate is washed with warm solution of magnesium sulphate. In the filtrate the albumin is precipitated by adding 0.3 cc. of 10 per cent acetic acid and boiling.

Modified provisional method for albumin.—The filtrate from casein, precipitated according to provisional method, is exactly neutralized by caustic alkali and then the albumin is precipitated by adding 0.3 cc. of 10 per cent acetic acid and boiling.

Both methods of determining casein gave fairly concordant results, those obtained with the magnesium-sulphate method being somewhat higher as a rule. The provisional and modified methods for albumin gave very unsatisfactory results and appeared to be faulty.

The provisional method for casein was made official. The magnesium-sulphate method was made an optional official method. The modified method for albumin was adopted as provisional until it can be further studied.

The Wollny method of saponification was made provisional and the reporter was directed to test it in comparison with other methods of saponification during the coming year.

Formic aldehyde (1 part to 2,500 of milk) is substituted for mercuric chlorid as a preservative for milk samples.

Water is to be determined in milk as follows: Heat to constant weight from 1 to 2 gm. milk in a tared flat dish having a diameter of not less than 5 cm., containing 15 to 20 gm. pure dry sand or without sand at the temperature of boiling water.

The second part of the report on dairy products was devoted to general methods of testing quality and detecting adulterations in milk, butter, and cheese (whole milk, filled, and skim milk), including cheese

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[1] U. S. Dept. Agr., Division of Chemistry Circ. 2.

standards and special methods of detecting formic aldehyde and borax and boracic acid in milk. The reporter recommended that a section of the methods for dairy products be devoted to adulteration.

LIQUORS AND FOOD ADULTERATION.

The report of W. D. Bigelow on this subject discussed chiefly the adulteration of canned goods, spices, condiments, etc., and gave compiled methods for examining flour, bread, mustard, pepper, cayenne, ginger, cinnamon, cloves, allspice, nutmeg, mace, cream of tartar, baking powder, vinegar, canned goods, wine, beer, and cider, with a separate chapter on the detection of preservatives. The recommendations of the reporter regarding methods and standards were referred to a committee of five, as follows: H. W. Wiley, H. A. Weber, M. A. Scovell, E. H. Jenkins, W. Frear.

SUGAR.

No report was submitted on this subject. H. W. Wiley stated that as far as he had observed the methods for sugar had proved satisfactory and needed little alteration. He called attention to the report on polarization by Wiley, Braid, and Crampton to the Treasury Department in connection with the fixing of the duty on sugars. He advised official chemists to have their polarization apparatus, etc., standardized by the Office of Weights and Measures of the U. S. Coast and Geodetic Survey. This will be done for such chemists free of charge.

TANNIN.

The report on tannin was submitted by J. H. Yocum, associate reporter. It gave the results of comparative tests by 5 analysts on different tannin extracts by official methods for tannin outlined by the reporter. As a result of the work a modification and revision of the methods, recommended by the reporter, was adopted by the Association.

A paper on the preparation of tannin extracts for analysis was presented by R. H. Forbes. In this it is shown that the official method for preparing extracts is not accurate. Percolation methods, modified for different substances, are recommended.

REPORT OF ABSTRACT COMMITTEE.

E. W. Allen submitted a brief report on the work of abstracting current literature relating to methods of analysis during the past year. The amount of work accomplished was fully equal to that done the preceding year, the published abstracts covering about 75 pages of the Experiment Station Record.

MISCELLANEOUS.

A report on volumetric standards was presented by B. W. Kilgore. This report explained the various systems used, urged the desirability of a uniform system, noted the progress which has been made in attempts to secure uniformity, and recommended that the true liter (1,000 gm. of water at 4° C. weighed *in vacuo*) be adopted as a unit, that specific gravity be always expressed in terms of water at 4° C., and that the average temperature of each laboratory be determined. This matter was referred to a committee of 5, consisting of B. W. Kilgore, C. L. Penny, E. E. Ewell, H. W. Wiley, and G. C. Caldwell, with instructions to take steps to carry out the recommendations of the report.

The executive committee was requested to take under consideration the advisability of issuing a programme of the proceedings with the call for the convention.

By action of the convention the names "reporter" and "associate reporter" were changed to "referee" and "associate referee."

The secretary was instructed to so classify and define the methods of analysis when published that there will be no confusion of strictly official methods with provisional methods.

E. E. Ewell suggested that in reporting the work of different analysts the individual determinations as well as the maximum, minimum, and average should be given, the general average being calculated from the sum of all determinations.

The privileges of the floor were granted to R. H. Atwater, who briefly discussed the fertilizing value of sulphate of ammonia, claiming that too low a valuation is generally given at present to the nitrogen in this material.

The Association spent one afternoon in inspecting the chemical laboratory of this Department and in paying their respects to the Secretary of Agriculture.

Resolutions of thanks were voted President Whitman and Dean Monroe, of Columbian University, the Cosmos Club, the Secretary of Agriculture, and President Frear and Secretary Wiley of the Association.

OFFICERS OF THE ASSOCIATION.

Officers were elected for the ensuing year as follows: President, A. L. Winton; vice-president, R. C. Kedzie; secretary, H. W. Wiley; executive committee, M. A. Scovell and J. L. Hills.

The referees and associate referees are as follows:

Phosphoric acid: Referee, B. W. Kilgore, Agricultural College, Miss.; associate referee, E. G. Runyan, Washington, D. C.

Nitrogen: Referee, R. J. Davidson, Blacksburg, Va.; associate referee, F. S. Shiver, Clemson College, S. C.

Potash: Referee, C. H. Jones, Burlington, Vt.; associate referee, B. B. Ross, Auburn, Ala.

Soils and ash: Referee, Harry Snyder, St. Anthony Park, Minn.; associate referee, B. L. Hartwell, Kingston, R. I.

Foods and feeding stuffs: Referee, W. H. Krug, Washington, D. C.; associate referee, G. L. Teller, Fayetteville, Ark.

Dairy products: Referee, C. L. Penny, Newark, Del.; associate referee, J. B. Weems, Ames, Iowa.

Liquors and food adulteration: Referee, W. S. Sweetser, State College, Pa.; associate referee, Chas. P. Worcester, Boston, Mass.

Sugar: Referee, R. S. Hiltner, Lincoln, Nebr.; associate referee, Elton Fulmer, Pullman, Wash.

Tannin: Referee, J. H. Yocum, New York City, N. Y.; associate referee, O. Carr, Corry, Pa.

The abstract committee is as follows: E. W. Allen, J. T. Anderson, W. H. Beal, B. H. Hite, J. B. Lindsey, L. H. Merrill, A. A. Persons, J. P. Street, and F. W. Woll.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The determination of crude fiber in cereals, J. N. HURTY (*Chem. Ztg., 21 (1897), No. 50, p. 491*).—Having a large number of samples of coarse wheat flour to analyze in a short time, the author employed the following method: Two grams of air-dry flour was boiled in a half-liter flask with 200 cc. of saturated salt solution and 5 cc. of hydrochloric acid of 1.16 specific gravity until the starch was inverted, which required about 10 minutes. After filtering through a Gooch crucible the residue was washed first with hot water, then with 200 cc. of hot 2 per cent sodium hydrate, and finally with water, alcohol, and petroleum ether. The residue was dried at 110°, weighed, ignited, and the ash deducted. In 5 trials the average by the official method was 2.48 per cent and by the "salt method" 2.53 per cent of crude fiber. In 5 comparisons on bran the official method gave an average of 11.84 per cent and the salt method 11.91 per cent of crude fiber. The time required for making the determination, exclusive of drying and igniting, was about 20 minutes.

The determination of phosphoric acid, H. LASNE (*Bul. Soc. Chim. Paris, 3. ser., 17 (1897), No. 16–17, pp. 823–832*).—This is a summary of results obtained in experiments during several years to determine the influence of varying conditions upon the accuracy of the determination of phosphoric acid by precipitation with magnesium salts in the presence of ammonium citrate. The questions studied were the influence of the length of time allowed for precipitation, the accuracy of the determination when mechanical agitators were used, the influence of the dilution of the solution, and the causes of plus errors in the determination under certain conditions.

The conclusions reached are briefly as follows: The determination of phosphoric acid in the form of pyrophosphate by the above method without any precaution except the previous removal of the silica gives accurate results as a rule. In rapid precipitation a plus error is observed, due to the formation of tri-magnesium phosphate, which is not entirely transformed into ammonium-magnesium phosphate unless the solution contains a sufficient amount of ammonium citrate (10 gm. of citric acid to 150 cc. of the solution) and is allowed to stand at least 16 hours. In order, therefore, to obtain absolutely accurate results the solution after precipitation should be allowed to stand over night. This plus error, however, is so small that it may be neglected in rapid methods designed for industrial work. The transformation of the tri-magnesium phosphate into ammonium-magnesium phosphate is very slow in the presence of ammonium chlorid alone. It is advisable, therefore, in every case to add the required amount of citrate. The precipitation of magnesium in the presence of an excess of ammoniacal phosphate gives a minus error as great as the plus error observed when the phosphoric acid is precipitated in the same solution. It thus appears that this classic method for the determination of magnesia is always inaccurate.

Volumetric estimation of phosphoric acid, B. W. KILGORE (*North Carolina Sta. Bul. 140, pp. 123–128*).—This is an account of comparative tests of the Pemberton method as modified by Kilgore and others[1] on North Carolina, South Carolina, Florida, Tennessee, and Pennsylvania phosphates; cotton-seed meal, tankage, sodium phosphate, aluminum phosphate, Thomas slag, bone meal, acid phosphate, and mixed fertilizers, to determine the accuracy of the method as applied to substances of widely varying composition, and to ascertain the amount of washing necessary to free the yellow precipitate from acid. The method gave as good results as the gravimetric method on all the samples analyzed. In fact, on materials containing large amounts of iron it apparently gave better results than the gravimetric method.

The influence of the amount of wash water was tested by using 200 and 500 cc. of water and of wash solutions. The results showed that 200 cc. of water was sufficient in all cases and that the use of 500 cc. of water did not lower the results at all or only very slightly.

"When 200 cc. of 3 per cent ammonium and potassium nitrate solutions were used for washing the results were practically the same as those obtained when the two quantities of water were used; but when they were washed with 500 cc. the results, greatly to my surprise, were much lower. The results were so surprising that quite a number of them were repeated, and while they were not uniform in all cases they were always low. We had hoped to be able to wash with a very large volume of ammonium nitrate without appreciably dissolving the precipitate or causing it to run through the filter. The filtrates from these 500 cc. ammonium and potassium nitrate washes were perfectly clear, but on evaporation the ammonium phosphomolybdate was found to be in solution."

The determination of potash by reduction of potassium-platinum chlorid with sodium formate, B. SJOLLEMA (*Chem. Ztg., 21 (1897), No. 74, pp. 739, 740*).—The author briefly discusses the various sources of error in the determination of potash by the methods generally employed, and recommends a modification of the method of Corenwinder and Contamine,[2] which is as follows: A portion of the potash solution, corresponding to 0.5 gram of substance, is slightly acidified

[1] U. S. Dept. Agr., Division of Chemistry Buls. 43, p. 68; 47, p. 62, and 49, p. 75; North Carolina Sta. Bul. 119; Jour. Amer. Chem. Soc., 16 (1894), p. 765; 17 (1895), p. 941 (E. S. R., 6, pp. 180, 376, 502; 7, pp. 264, 741).

[2] Bul. Soc. Ind. du Nord, 1879.

with hydrochloric acid, platinum chlorid added, and the solution evaporated on a water bath to a sirupy consistency. After completely cooling, the residue is covered with a mixture of 9 parts of 95 per cent alcohol and 1 part of ether and allowed to stand several hours. It is then brought upon a filter and washed with the same mixture. The precipitate of potassium-platinum chlorid is dissolved on the filter with hot water, and the platinum salt is reduced by pouring this hot solution into a boiling solution of sodium formate. Heating the solution for a short time causes the metallic platinum to flocculate so that it is easily collected on the filter and washed. The metal is brought upon the filter by means of cold, slightly acidified water, and finally washed with boiling water. It is then dried, ignited, and weighed. Ninety per cent alcohol has been substituted for the mixture of alcohol and ether in the author's laboratory with very satisfactory results.

On the use of sodium superoxid for separating iron oxid and alumina, C. GLASER (*Chem. Ztg., 21 (1897), No. 69, p. 678*).—If the solution does not contain phosphate of lime it is simply necessary to nearly neutralize with ammonia before employing the method of separation of iron and alumina. If phosphate of lime is present the greater portion of it should be removed by means of ammonium acetate or by Glaser's method, the lime-free solution then being nearly neutralized. To the cool solution should be added sufficient dry sodium superoxid to produce a clear solution, from 3 to 6 gm. of superoxid to each 0.4 gm. of substance being usually sufficient. The solution should be heated for a short time at boiling temperature, allowed to settle, and filtered through a thick filter. The alumina in the filtrate is determined after acidifying in the usual way. The author recommends precipitating twice as aluminum phosphate by adding phosphoric acid and ammonium acetate. The iron on the filtrate is dissolved in hydrochloric acid and precipitated again in order to purify it.

The results obtained by this method on a number of phosphates agreed quite closely with those obtained by the fusion method.

On the determination of iron oxid and alumina in phosphates, N. BLATTNER and J. BRASSEUR (*Bul. Soc. Chim. Paris, 3. ser., 17 (1897), No. 15, pp. 760, 761*).—The author compared the acetic acid, Glaser, Lasne, von Grüber, Gladding, and Thomson methods, with the following results: The first gave results entirely too low, the acetic acid retaining a considerable amount of aluminum in solution. The Glaser method was sufficiently accurate when manganese was absent and was rapid and easy. The method of Lasne[1] gave scientifically exact results when all the details of the method, as described by the author, were carefully observed. Von Grüber's[2] method is considered simply an abridged or, more properly, a mutilated form of Lasne's method, and gave inaccurate results. Gladding's[3] method, using caustic potash, is

[1] Bul. Soc. Chim. Paris, 15 (1896), p. 118 (E. S. R., 7, p. 915).
[2] Ztschr. angew. Chem., 1896, p. 741 (E. S. R., 8, p. 559).
[3] Jour. Amer. Chem. Soc., 18 (1896), p. 721.

similar to that of Lasne, containing modifications in certain details which are likely to cause error. Thomson's method of direct precipitation of the phosphates of iron and aluminum by ammonia gave results which varied with the character of the phosphates tested, and the precipitate always contained lime.

A source of error in the Kjeldahl method of determining nitrogen, B. SJOLLEMA (*Chem. Ztg., 21 (1897), No. 74, pp. 740, 741, figs. 3*).—A number of tests are reported showing the large errors which may be introduced into the determination of nitrogen by the Kjeldahl method by the bumping of the solution and the carrying over of alkali into the distillate. The author describes two forms of safety bulbs which he has found effective in removing all danger of error from this source.

Review of chemistry in the form of tabular synopses, A. BUGUET (*Résumés de chimie sous forme de tableaux synoptique. Paris: Société d'Edit Scientif. Brochure; rev. in Jour. Hyg., 22 (1897), No. 1073, p. 180*).

On the experimental determination of the hydrothermal value of a bomb calorimeter, H. W. WILEY and W. D. BIGELOW (*Jour. Amer. Chem. Soc., 19 (1897), No. 6, pp. 439–451*).

Yellow light for the polarimeter, F. DUPONT (*Bul. Soc. Chim. Paris, 17 (1897), No. 12, pp. 584, 585*).

Spontaneous combustion of molasses, J. T. CRAWLEY (*Jour. Amer. Chem. Soc., 19 (1897), No. 7, pp. 538–542*).

On the intervention of manganese in the oxidation due to laccase, G. BERTRAND (*Bul. Soc. Chim. Paris, 3. ser., 17 (1897), No. 12, pp. 619–624*).

On the oxidizing power of manganese salts and on the chemical composition of laccase, G. BERTRAND (*Bul. Soc. Chim. Paris, 3. ser., 17 (1897), No. 15, pp. 753–756*).

On the composition and pentosans of peat, on fermentation experiments with peat, and on the supposed formation of humin from sugar by means of potassium permanganate, H. VON FEILITZEN (*Ueber die Zusammensetzung und die Pentosane des Torfes, über Gährungsversuche mit Torf, und über die angebliche Huminbildung aus Zucker mit Katiumpermanganat. Göttingen: Vandenhoeck & Ruprecht, 1897*).

The chemistry of starch, C. J. LINTNER (*Chem. Ztg., 21 (1897), Nos. 74, pp. 737, 738; 75, pp. 752–754*).—This is a résumé of work done by different chemists on this subject.

Products of the saccharification of starch by diastase, P. PETIT (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 6, pp. 355–357*).

On the specific rotation of maltose and soluble starch, H. T. BROWN, G. H. MORRIS, and J. H. MILLAR (*Chem. News, 75 (1897), No. 1939, p. 43*).

A recalculation of Wein's table of starch equivalent to copper found, based on the factor 0.92, W. H. KRUG (*Jour. Amer. Chem. Soc., 19 (1897), No. 6, pp. 452–454*).

On the relation of the specific rotatory and cupric-reducing powers of the products of starch hydrolysis, H. T. BROWN, G. H. MORRIS, and J. H. MILLAR (*Chem. News, 75 (1897), No. 1939, p. 43*).

The determination of starch in the grains of cereals, L. LINDET (*Bul. Soc. Chim. Paris, 15–16 (1896), pp. 1163, 1164*).

The identity of dextrose from different sources with special reference to the cupric oxid reducing power, C. O'SULLIVAN and A. L. STERN (*Jour. Chem. Soc. [London], 69 (1896), pp. 1691–1702*).

A résumé of progress in the chemistry of the carbohydrates during 1896, W. E. STONE (*Amer. Chem. Jour., 19 (1897), No. 7, pp. 608–621*).

On the recognition of carbohydrates, B. SJOLLEMA (*Chem. Ztg., 21 (1897), No. 74, p. 739*).

The carbohydrates of barley straw, C. F. CROSS, E. J. BEVAN, and C. SMITH (*Jour. Chem. Soc.* [*London*], *69* (*1896*), *pp. 1604–1610*).

Analysis of fats and waxes, R. BENEDIKT, edited by FERDINAND ULZER (*Analyse der Fette und Wachsarten. Berlin: Julius Springer, 1897, pp. 675, pl. 1, figs. 48*).—An enlarged edition of a standard work.

On the examination of beeswax, S. WEINWURM (*Chem. Ztg.*, *21* (*1897*), *No. 52, pp. 519, 520*).

On oxicellulose, L. VIGNON (*Compt. Rend. Acad. Sci. Paris, 125* (*1897*), *No. 12, pp. 448–450*).

The cause of rancidity of fat, J. A. MJÖEN (*Forsch. Ber. Lebensmtl.*, *4* (*1897*), *No. 8, pp. 195–203, figs. 2*).

A contribution to the chemistry of animal fats, C. AMTHOR and J. ZINK (*Ztschr. analyt. Chem.*, *36* (*1897*), *No. 1, pp. 1–17*).—This is quite an elaborate paper on the various animal fats. The authors summarize the specific gravity, melting point, solidification point, iodin number, Reichert number, Hehner value, saponification equivalent, etc., for the fats and fatty acids obtained from 26 different animals.—B. W. KILGORE.

On the analysis of fat, G. DRECHSLER (*Ztschr. Fleisch u. Milchhyg.*, *7, No. 12, pp. 231–234*).

Concerning the action of pepsin and rennet, R. PFLEIDERER (*Arch. gesam. Physiol.* [*Pflüger*], *66* (*1897*), *No. 11–12, pp. 605–634*).—Artificial digestion, precipitation of casein, etc.

On the formation of ammonia in wines, A. MÜNTZ and E. ROUSSEAUX (*Ann. Sci. Agron.*, *1897, I, No. 3, pp. 400–414*).

Determination of glycerin in wine and the indirect determination of mannite in mannited wines, G. MANCUSO-LIMA and S. GIUS (*Atti Staz. chim. agr. Sper. Palermo, Rap. 1893–'95, pp. 48–55*).

On the determination of glycerin in wine, C. BOETTINGER (*Chem. Ztg.*, *21* (*1897*), *No. 67, pp. 658, 659*).

On the determination of cream of tartar in wines, H. JAY (*Bul. Soc. Chim. Paris, 3. ser.*, *17* (*1897*), *No. 12, pp. 626–629*).

On researches on salicylic acid in wines, M. SPICA (*Atti Staz. chim. agr. Sper. Palermo, Rap. 1893–'95, pp. 64–73*).

The detection of salicylic acid in beer, wine, and fruit juices (*Ztschr. Nahr. Untersuch. u. Hyg.*, *11* (*1897*), *No. 15, p. 255*).

The use of phloroglucin for detecting formalin in milk, JORISSEN (*Jour. Pharm. et Chim.*, *6. ser.*, *6* (*1897*), *No. 4, p. 167*).

Introduction to chemico-technical analysis, F. ULZER and A. FRAENKEL (*Anleitung zur chemisch-technischen Analyze. Berlin: Julius Springer, 1897, illus.*).

Elementary analysis with the Berthelot bomb, K. KROECKER (*Ber. deut. chem. Gesell.*, *30* (*1897*), *pp. 605–607; abs. in Chem. Centbl.*, *67* (*1897*), *No. 18, pp. 939, 940*).—The author modified the bomb calorimeter so that water produced by combustion could be determined.

Principles of chemical analysis, FINK (*Précis d'analyse chimique. Paris: Carré & Naud; rev. in Jour. Hyg.*, *22* (*1897*), *No. 1073, p. 180*).

Simplification of elementary organic analysis, M. DENNSTEDT (*Ber. deut. chem. Gesell.*, *30* (*1897*), *p. 1590; abs. in Chem. Ztg.*, *21* (*1897*), *No. 69, Repert., p. 179, fig. 1*).

Determination of fat in milk, H. FRESENIUS (*Ztschr. analyt. Chem.*, *36* (*1897*), *No. 1, p. 31*).—The author evaporates the milk on purified quartz sand, dries, extracts with dry ether, evaporates the ether, dries, and weighs.—B. W. KILGORE.

Estimation of fat in milk, LIEBERMANN and SZEKELY (*Jour. Med. Vet.*, *1896, Feb.; abs. in Ztschr. Fleisch u. Milchhyg.*, *7, No. 7, p. 142*).—Description of a method in which petroleum ether is used in place of ether.

The estimation of milk sugar in milk, A. ORTMANN (*Ztschr. Nahr. Untersuch. u. Hyg.*, *11* (*1897*), *No. 16, pp. 265, 266*).

New means of distinguishing between butter and margarin, J. HOFFMANN (*Chem. Ztg., 21 (1897), No. 57, pp. 571, 572, fig. 1*).—This depends upon the form of drops of ether or alcoholic solutions of butter and margarin when allowed to fall upon glass and on the amount of residues left behind.

Analysis of cheese, E. J. LOVE (*Chem. Ztg., 21 (1897), No. 52, p. 523*).—The author treats cheese with a small quantity of ether and then dries the residue at 100°, after which it can be pulverized and completely extracted in a Soxhlet extraction apparatus. The residue is brought upon a tared filter, dried, and weighed; and the ether extract is dried and weighed as fat. The difference between 100 and the sum of the ether extract and of the residue of cheese represents the liquid constituents.

The recognition of margarin in cheese, H. BREMER (*Forsch. Ber. Lebensmtl., 4 (1897), No. 3, pp. 51–53*).

A simple new iodometric method of estimating sugar, K. B. LEHMANN (*Arch. Hyg., 30 (1897), No. 3, p. 267*).

The quantitative determination of nitric acid by electrolysis, K. ULSCH (*Ztschr. Electrochem., 3 (1897), p. 546; abs. in Chem. Ztg., 21 (1897), No. 71, Repert., p. 192*).

The rapid estimation of uric acid in urine, E. H. BARTLEY (*Jour. Amer. Chem. Soc., 19 (1897), No. 8, pp. 649–656*).

On the spectroscopic detection and determination of potassium, F. A. GOOCH and T. S. HART (*Amer. Jour. Sci., 42, p. 448*).

On the determination of caffein in coffee, E. TASSILLY (*Bul. Soc. Chim. Paris, 3. ser., 17 (1897), No. 15, pp. 761–768*).

Determination of formic aldehyde, G. ROMIJN (*Ztschr. analyt. Chem., 36 (1897), No. 1, p. 18*).—The author prefers the iodometric method for pure solutions of formic aldehyde. If the presence of other aldehydes is feared the potassium-cyanid method is used, often in combination with the iodometric method. The methods of Brochet and Cambier are also recommended.—B. W. KILGORE.

A further communication on the estimation of phosphoric acid by titration of the ammonium phospho-molybdate precipitate with standard alkali, B. W. KILGORE (*Jour. Amer. Chem. Soc., 19 (1897), No. 9, pp. 703–711*).—This is the same as the article published in Bulletin 140 of the North Carolina Station. (See page 416.)

The detection of coloring matter in sausage, H. WELLER and M. RIEGEL (*Forsch. Ber. Lebensmtl., 4 (1897), No. 8, pp. 204, 205*).

Detection of sulphocyanates, C. L. PENNY (*Delaware Sta. Rpt. 1896, pp. 158, 159*).—A method is described for the detection of sulphocyanates.

Hygienic studies of copper: Method of estimating small quantities, K. B. LEHMANN (*Arch. Hyg., 30 (1897), No. 3, p. 250*).

Method of collecting and analyzing the gases of canned goods, C. A. DOREMUS (*Jour. Amer. Chem. Soc., 19 (1897), No. 9, pp. 733–735, fig. 1*).

The composition of nicotin, V. OLIVERI (*Atti. Staz. chim. agr. Sper. Palermo, Rap. 1893–'95, pp. 31–47*).

BOTANY.

New species of fungi, J. B. ELLIS and B. M. EVERHART (*Bul. Torrey Bot. Club, 24 (1897), No. 10, pp. 457–477*).—Descriptions are given of a miscellaneous lot of fungi from many localities.

New species of North American fungi, J. B. ELLIS and B. M. EVERHART (*Bul. Torrey Bot. Club, 24 (1897), No. 6, pp. 277–292*).

Mexican fungi, E. W. D. HOLWAY (*Bot. Gaz., 24 (1897), No. 1, pp. 23–38*).—Notes and descriptions are given of numerous species of parasitic fungi from Mexico.

Fungi for class demonstration, W. G. P. ELLIS (*Ann. Bot., 11 (1897), No. 42, pp. 333, 334*).

Some cryptogams found in the air, S. E. JELLIFFE (*Bul. Torrey Bot. Club, 24 (1897), No. 10, pp. 480, 481*).—A list is given of 4 species of Saccharomycetes, 5 of Mucorini, and 19 of Hyphomycetes that occur as contaminations in bacterial cultures. They have all been grown on Petrie dishes.

New or noteworthy American grasses, VII, G. V. NASH (*Bul. Torrey Bot. Club, 24 (1897), No. 7, pp. 344–350*).—*Erianthus laxus, Panicum atlanticum, P. parvispiculum, Panicularia borealis*, and *P. brachyphylla* are described as new.

Marram grass (*Kew Misc. Bul., 1897, No. 127, p. 211*).—This grass, *Ammophila arundinacea*, is said to be an excellent binder for sand dunes, etc.

A monograph of the Geoglosseæ, G. MASSEE (*Ann. Bot., 11 (1897), No. 42, pp. 225–306, pls. 2*).

Notes on the oxydase of mushrooms, R. FERRY (*Rev. Mycol., 19 (1897), No. 76, pp. 130–141*).—Notes are given on tyrosinase.

Phallin, KOBERT (*Rev. Mycol., 19 (1897), No. 76, pp. 121–127*).—The origin and action of this toxalbumin are described.

On the development of the Uredineæ, J. SCHROETER (*Abs. in Bot. Centbl., Beihefte 7 (1897), No. 1, pp. 3, 4*).

Some physiological properties of a Myxomycete plasmodium, J. B. CLIFFORD (*Ann. Bot., 11 (1897), No. 42, pp. 179–186, figs. 3*).

The functions of latex, R. H. BIFFIN (*Ann. Bot., 11 (1897), No. 42, pp. 334–339*).

On the structure and function of stomata on petals and anthers, GRACE D. CHESTER (*Ber. deut. bot. Gesell., 15 (1897), No. 7, pp. 420–431, pl. 1*).

On the presence of soluble starch in the leaves of Cola, P. GUERIN (*Bul. Soc. Bot. France, 44 (1897), No. 2, pp. 91–95*).

The phenomena of symbiosis, A. SCHNEIDER (*Minn. Bot. Studies, 1897, Bul. 9, Pts. X, XI, pp. 922–948*).—The author discusses symbiosis in general, and gives a bibliography of about 75 titles in addition to those given in Bulletin 9, Part IV of this series.

The forces determining the position of dorsiventral leaves, R. N. DAY (*Minn. Bot. Studies, 1897, Bul. 9, Pts. X, XI, pp. 743–752*).

Concerning the assimilatory tissue of stems deprived of their leaves, A. BOIRIVANT (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 6, pp. 368–370*).—A report of experiments conducted with quite a range of plants is given. The foliage was removed and the changes in tissue noted. The stems or petioles, where only the blade of the leaf was removed, was able to develop a considerable amount of chlorophyll-bearing tissue, as well as numerous changes in the cell structure, stomatic arrangement, etc.

Studies on the fertilization of Zamia, H. J. WEBBER (*Bot. Gaz., 23 (1897), No. 6, pp. 453–459, pl. 1; 24 (1897), No. 1, pp. 16–22, figs. 5*).—The author reports upon the discovery of antherozoids in the pollen tubes of Zamia. They are remarkable on account of their size, being visible to the unaided eye.

Notes on the fecundation of Zamia and the pollen tube of Ginkgo, H. J. WEBBER (*Bot. Gaz., 24 (1897), No. 4, pp. 225–235, pl. 1*).

The correlation of growth under the influence of injuries, C. O. TOWNSEND (*Bot. Gaz., 24 (1897), No. 3, p. 191*).—Abstract of a paper read before Section G of the American Association for the Advancement of Science at the Detroit meeting, August, 1897.

Comparative anatomy of the normal and diseased organs of Abies balsamea affected with Æcidium elatinum, A. P. ANDERSON (*Bot. Gaz., 24 (1897), No. 3, p. 191*).—Abstract of a paper read before Section G of the American Association for the Advancement of Science at the Detriot meeting, August, 1897.

The toxic action of phenols on plants, R. H. TRUE and C. G. HUNKEL (*Bot. Gaz., 24 (1897), No. 3, p. 190*).—Abstract of a paper read before Section G of the American Association for the Advancement of Science at the Detroit meeting, August, 1897.

Phyllogeny and taxonomy of angiosperms, C. E. BESSEY (*Bot. Gaz., 24 (1897), No. 3, pp. 145–178*).—Address as retiring president of the Botanical Society of America, delivered at Toronto, August 17, 1897.

A convenient potometer, D. T. MACDOUGAL (*Bot. Gaz., 24 (1897), No. 22, pp. 110–114, fig. 1*).—Figures and describes a simple device for measuring the amount of water taken up by a plant.

On the development of the growing points of the stems of cotyledons, J. BARANETZKY (*Ann. Sci. Nat. Bot., 8. ser., 3 (1897), No. 3–6, pp. 311–365, pls. 3*).

Histology of the cell wall, with special reference to the mode of connection of cells, W. GARDINER (*Proc. Roy. Soc. [London], 62 (1897), No. 380, pp. 100–112, figs. 8*).

On the nature of certain pigments produced by fungi and bacteria, with special reference to that produced by Bacillus solanacearum, E. F. SMITH (*Bot. Gaz., 24 (1897), No. 3, pp. 192, 193*).—Abstract of a paper read before Section G of the American Association for the Advancement of Science at the Detroit meeting, August, 1897. The dark-brown pigment produced by the potato-rot bacillus will not dialyze, or very imperfectly, and is precipitated by calcium and iron compounds. It is suggested as possible that the humus compounds of the soil are due to the chemical action of fungi and bacteria on the carbohydrate material of animals and plants, especially the latter.

The red pigment of flowering plants, F. W. KEEBLE (*Science Progress, n. ser., 1 (1897), No. 4, pp. 406–423*).

On the assimilatory energy of blue light, F. G. KOHL (*Ber. deut. bot. Gesell., 15 (1897), No. 7, pp. 361–366, pl. 1*).

A new method of drying succulent plants, C. LE GENDRE (*Bul. Soc. Bot. France, 44 (1897), No. 6, pp. 267, 268*).

ZOOLOGY.

Susceptibility of spermophiles to pathogenic bacteria, A. B. KIBBE (*Washington Sta. Bul. 21, pp. 8*).—An account is given of a number of experiments made upon several species of ground squirrels, including *Spermophilus columbianus*, *S. townsendi*, and *S. mollis*, with several species of bacteria, with a view to finding some germ that may be used to attack these mammalian pests by taking advantage of their habit of devouring their dead companions.

Reference is made to experiments by Mereshkovsky[1] and Palmirski.[2] The former relates that some 150 specimens of Spermophilus died from an infection due to eating their dead companions. He prepared bouillon cultures of vibrio-metschnikovi and injected them into young pigeons, and made cultures from the heart blood of these. These cultures upon injection into 7 full-grown pigeons resulted in the death of the birds within 7 hours. With the germs thus virulent 2 specimens of *Spermophilus columbianus* and 2 specimens of the other species noted were inoculated with 0.5 cc. of a 24-hour-old bouillon culture grown in an incubator. A young pigeon used as a control was inoculated with a similar amount. On the same evening the pigeon died and then was placed in a cage containing 4 specimens of *Spermophilus columbianus*, which devoured the greater part of the bird during the night. Some 48 hours later one of the small inoculated squirrels was dead, and an examination showed the vibrio-metschnikovi in pure culture. The rest of the animals, though watched for several weeks, presented no evidence of having been affected by the inoculation.

To test the suggestion that the comparative absence of ground squir-

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[1] Centbl. Bakt. u. Par., 17 (1895), p. 742.

[2] Arch. Sci. Biol., St. Petersbourg, 2, p. 497.

rels from localities where hogs are raised may be due to their susceptibility to the germ of hog cholera or swine plague, several squirrels were inoculated with the germs of this disease, but with entirely negative results.

Germs developing in putrid blood of calves were next tried. At the end of 6 weeks 1 of the animals died, but careful examination gave no evidence of the bacterium either in the blood or tissues.

Another experiment in which the cages of the animals were allowed to become very foul resulted in the death of 2 of the animals (*Spermophilus columbianus*). An examination showed considerable changes in the internal organs, and cover-glass preparations from heart blood brought to light a number of short bacilli somewhat thinner, but otherwise similar to the typhoid bacilli which were also found in bouillon cultures from the spleen and kidneys grown on agar in an incubator. Its growth in cultures is described. Some 24 hours after the death of the 2 animals noted a third one was found dead and upon examination the same internal appearances were seen, and cultures gave the same bacillus. Testing the new bacillus upon rabbits, guinea pigs, and white rats showed it to be nonpathogenic for these animals.

In March, 1896, a culture of the bacillus isolated in Mareskovski's experiments was received and experimented with upon the different species of Spermophilus, each animal receiving 0.5 cc. of a fresh bouillon culture. Specimens of *Spermophilus townsendi* after 2 weeks were still apparently in a healthy condition. Another small Spermophilus was then tried and was found dead 24 hours later. The body was placed in the cage of the specimens of *S. townsendi*, and 6 days later 1 of these was found dead. An examination showed a condition in the abdominal organs as described by Mereskovski. Cultures produced the bacillus in pure state. The remains of the animal were fed to others, but without result. Other animals left over from the previous year's experiments were injected with fatal results.

In conclusion the author thinks the question has more sides than was was at first anticipated, but it is thought that a germ may be found that may prove pathogenic for at least 1 or 2 species, and ultimately such as will be fatal in the case of other species. The fact is noted that the epidemics to which these animals are known to be more or less subject need study by competent bacteriologists.

Lessons in elementary biology, T. J. PARKER (*London: Macmillan & Co., 1897, 3d ed., pp. 503; rev. in Naturw. Rundschau, 12 (1897), No. 42, p. 540*).—This excellent work has in this third edition been somewhat enlarged so as to treat more fully of higher animals and plants.

The effect of great cold on animalcules, worms, insects, and other animals, J. WEIR, Jr. (*Scient. Amer., 77 (1897), No. 17, p. 268*).—Notes on a number of experiments with the animals named, demonstrating that they may be frozen without serious injury.

Effect of the season on migration, H. J. GIDDINGS (*Iowa Nat., 3 (1897), No. 3, pp. 41, 42*).—Migration is attributed to a general restlessness except during the breeding season. During the present season many species did not arrive with their accustomed promptness.

METEOROLOGY—CLIMATOLOGY.

Monthly Weather Review (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 25 (1897), Nos. 4, pp. 123–188, charts 6; 5, pp. 189–234, charts 5; 6, pp. 235–283, charts 5*).—Besides the usual summaries, No. 4 contains articles on The early use of wire in kite flying, by S. B. Fergusson; Cloud measurements at Blue Hill, by H. H. Clayton; The mechanics and equilibrium of kites (figs. 23), by C. F. Marvin (see p. 427); and notes by the editor on seasonal forecasts for Oregon, cloud heights—a problem for students (fig. 1), the Franklin kite club, the kite as used by Espy, the kite used in 1822 by Fisher, Archibald on kites, efficiency of windmills, the Franklin kite club and James Swaim, and kites in America and Europe.

No. 5 contains special articles on Clothing and temperature, by W. F. R. Phillips (see p. 425); The standard system of coordinate axes for magnetic and meteorological observations and computations, by F. H. Bigelow (see p. 426); Aurora australis of April 20, by M. W. Campbell-Hepworth; Wind-barometer table, by E. B. Garriott (see p. 426); and notes by the editor on weather telegraphy in England and America, Captain Dansey's kite for stranded vessels, Kerkam's kites with rocket signals, the use of the searchlight in meteorology, waterspouts off Long Island, waterspout, cloudburst, or tornado, character of the skylight, atmospheric vapor, the meteorological use of the term "local," water measurements for irrigation, melting snow, and river floods, snowfall in Colorado, evaporation at Fort Collins, Colorado, hail and a rain gauge for its management, ignis fatuus or Jack-o'-lantern, current weather and future crops, secular changes in climates and crops, peculiar mountain storms, cirrus clouds on the northwest side of a storm, Mexican climatological data, anchor ice, the chinook and the signs of its approach, and frost formations.

No. 6 contains special contributions on Temperature and rainfall at Mersivan, Turkey; Whirling alto-stratus (pl. 1), by A. D. McAdie; The problem of the kite, by A. D. McAdie; Climate of Alaska, by A. J. Henry (see below); and notes by the editor on records of foggy and cloudy days, homogeneity and uniformity, electrical districts, tornado frequency per unit area, thunderstorms at Eustis, Lake County, Florida, frequency of thunderstorms, movements of winds and clouds in Minnesota, hourly results from self-registers, recent earthquakes, Mexican climatological data, seismographs at meteorological stations, climate and crime, climatological data for Jamaica, West Indies, hot winds in Missouri, hot winds in Kansas, and a bright meteor.

Meteorology, W. H. BISHOP (*Delaware Sta. Rpt. 1896, pp. 163–177*).—Monthly summaries of observations on temperature, atmospheric pressure, and precipitation during the fiscal year ending June 30, 1896, and a summary of observations on temperature and precipitation during the calendar year 1895 are given and the data briefly discussed.

The summary for 1895 is as follows:

Annual summary of meteorological observations in Delaware.

	Newark.	Middle-town.	Dover.	Milford.	Seaford.	Mills-boro.
Temperature (° F.):						
Highest	97	102	98	99	97	98
Lowest	—4	—4	—1	1	—2	—1
Mean	51.27	52.15	53.38	54.88	53.83	53.50
Rainfall (inches), total	34.59	39.79	35.51	38.51	41.97	42.14
Number of days on which 0.01 inch or more of rain fell	83	83	78	96	87	114

Report on the relative humidity of southern New England and other localities, A. J. HENRY (*U. S. Dept. Agr., Weather Bureau Bul. 19, pp. 23, pls. 4*).—In view of the quite general belief that a humid atmosphere is essential to the successful spinning and weaving of cotton fabrics the data obtained from observations on the relative humidity at different points in New England, the Gulf Coast, the Piedmont Plateau, and northern central New York have been compiled with a view to "ascertaining how the natural humidity of certain portions of the United States, particularly the South where the extension of the art is most pronounced, compares with that of the southern shore of New England." For comparative purposes similar observations at different points in England where cotton manufacturing is most successfully conducted are added.

"It would appear that thus far in the development of the cotton manufacturing industry little account has been taken of climatic conditions as affecting the quantity or quality of the output. It is also apparent that the relative humidity of the atmosphere depends not only on the absolute quantity of vapor present in the air, but also on the temperature which determines the point of saturation, and that these elements vary both as regards time and geographic situation."

Clothing and temperature, W. F. R. PHILLIPS (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 25 (1897), No. 5, pp. 200, 201; Doc. 126, pp. 6*).—To study the influence of meteorological conditions upon personal comfort and upon the efficiency of clothing, series of observations of temperature between the coat and vest, the vest and linen shirt, the linen shirt and woolen undershirt, the undershirt and skin, and under the tongue were made (1) indoors, (2) after free exposure out of doors for 10 minutes, (3) after free exposure out of doors for 20 minutes, and (4) 10 minutes after returning indoors. All observations were made in the shade between 1.50 and 2.30 p. m. during the period from February 4 to February 16, 1897.

The results of the different series of observations are tabulated, and while no positive conclusions are deemed warranted by the data, attention is called to the following points:

"The temperature of the different layers of clothing was influenced decidedly by the prevailing temperature of the immediate surroundings, the former rising and falling with rises and falls in the latter, but the degree of change was variable, and perhaps, if not certainly, was very much affected by the velocity of the wind. There was one point wherein a result of the writer's experiments differed from a corresponding one as given by Van Bebber, i. e., that the lower the atmospheric temperature the lower also was the temperature between the woolen shirt and the skin; this was contrary to Rubner's experience. . . .

"Another point noticed was in connection with the temperature of the body as shown by that taken in the mouth. Upon going outdoors the body temperature always fell, and the fall was greater in proportion to the time of exposure. Furthermore, upon returning indoors it did not rise quickly, but 10 minutes afterwards remained as low as the last observation outdoors. Although no systematic observations were made with reference to ascertaining the time required for the body to regain its original degree, yet in the few casual experiments that were made it took from 20 to 30 minutes."

The standard system of coordinate axes for magnetic and meteorological observations and computations, F. H. BIGELOW (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 25 (1897), No. 5. pp. 201–204; Doc. 124, pp. 7*).—The coordinate systems employed by 13 different authorities on terrestrial magnetism and meteorology are collected in tables for the purpose of comparison.

"While there are some variations in the literature of meteorology, Ferrel's system has happily helped to put some of the analytical papers on the motions of the atmosphere in an acceptable form. Developing the angle θ from the north pole, and the angle λ toward the east, with radius extended to the zenith, the system x south, y east, z zenith, with u, v, w for velocity, and $\frac{du}{dt}, \frac{dv}{dt}, \frac{dw}{dt}$ for acceleration, gives a notation which, if used by all writers, would reduce the labor of the comparative study of the laws of the dynamics of the atmosphere to a minimum."

Climate of Alaska, A. J. HENRY (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 25 (1897), No. 6, p. 248*).—A table gives the monthly and annual mean temperature of 8 coast (from Fort Wrangell to Point Barrow) and 7 interior stations, based on fragmentary series of observations by the Russian Government and by the United States Signal Service during periods varying from 4 months in case of Fort Yukon to 45 years in case of Sitka. For the coast stations the annual mean temperature varies from 7.7° F. at Point Barrow to about 44° F. at Sitka.

Meteorological record (*Minnesota Sta. Rpt. 1896, pp. 457–462*).—Tables give the normal monthly and annual temperature and precipitation at 28 stations in the State during periods of 5 or more years, and the mean monthly and annual temperature and precipitation at 68 stations during 1896.

Instructions for voluntary observers, W. L. MOORE (*U. S. Dept. Agr., Weather Bureau, Doc. 119, pp. 22, figs. 10*).—"The object of this pamphlet is to furnish voluntary observers with brief instructions for their guidance in taking and recording observations, more especially of temperature and rainfall." The following topics are discussed: Thermometer exposures and instrument shelter, description of maximum and minimum thermometers and instructions for uniting detached columns of alcohol, instructions for setting up maximum and minimum thermometers, rain gauge, and miscellaneous phenomena.

Wind-barometer table, E. B. GARRIOTT (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 25 (1897), No. 5, pp. 204, 205; Doc. 125, pp. 5*).—A table is given which presents "in form for ready reference, atmospheric signs [barometer and wind direction] which have been found to presage certain weather changes and conditions over the middle and upper Mississippi and lower Missouri valleys, the Great Lakes, the Ohio Valley, and the Middle Atlantic and New England States."

A monograph on the mechanics and equilibrium of kites, C. F. MARVIN (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 25 (1897), No. 4, pp. 136–161, figs. 23; Doc. 122, pp. 71, figs. 23*).—This monograph was awarded the Chanute prize offered by the Boston Aeronautical Society. It defines the kite and discusses the general and fundamental principles of physics and mechanics which underlie the action of kites and the relation of forces which is essential to their flight and stability. The application of these general theories and principles in particular cases is explained.

Résumé of solar observations at the royal observatory of the Roman College during the first quarter of 1897, P. TACCHINI (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 8, pp. 392–394*).

The recent storms in France, July and August, 1897, and the solar period, C. V. ZENGER (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 8, pp. 388–391*).

Investigation on the relation of atmospheric precipitation to plants and soils, E. WOLLNY (*Forsch. Geb. agr. Phys., 20 (1897), No. 1, pp. 111–131*).—The influence of rain, hail, snow, and sleet on plant growth is discussed on the basis of the author's observations and experiments.

WATER—SOILS.

The water supply of Cache Valley, S. FORTIER (*Utah Sta. Bul. 50, pp. 50, dgms. 8, map 1*).—The Cache Valley is nearly surrounded by mountains. A spur of the Wasatch range forms the elevated divide between it and Bear Lake Valley in Rich County to the east, and another spur of the same range forms the lower divide between it and Great Salt Lake and Malad River valleys to the west.

"The average elevation of the cultivated portion of the valley is about 4,500 ft.; its length from north to south varies from 40 to 50 miles, and its width from east to west from 10 to 15 miles."

A summary is given of the results of measurements made at different times during the year 1896 of the different streams flowing into Cache Valley and of the capacities of the ditches and canals in the same valley, together with accurate current meter measurements and daily records of the outflow of the valley through Bear River.

"The object sought was to determine the ratio existing between the inflow, diminished by the volumes used in irrigation, and the outflow. This ratio being known for a continuous period of 3 months, an opportunity is offered to compare the loss of water due to evaporation with the gain due to seepage from irrigated areas and from the adjacent hillsides.

"Other objects held in view, although of minor importance to the student of hydrography but possessing great value to the irrigator, were the average flow of the various ditches and canals, the amount of the surplus waters of the large streams, and the duty of the irrigating waters. . . .

"The mode of measurement adopted consisted in a determination of the cross section of the stream, canal, or ditch, after which the mean velocity of the water was found by a current meter."

Rainfall and evaporation, especially as related to this region, are briefly discussed. Diagrams constructed from the data obtained show the appropriated and unappropriated water (June 15 to September 15, 1896) of the Logan River, Blacksmith Fork River, Bear River, Cub River, Summit Creek and tributaries, and High Creek; and a table gives the summer flow of the principal streams of the valley.

The following table, showing the water supply of the Cache Valley and what becomes of it, has been compiled from more than 9,000 stream and canal measurements and estimates:

The water supply of Cache Valley exclusive of Bear River.

Date.	Inflow.	Used for irrigation.	Outflow.	Average monthly gain from seepage.
	Second-feet.	*Second-feet.*	*Second-feet.*	*Second-feet.*
June 15	3,275.8	1,163.1	2,659	
June 20	3,006.0	1,162.9	2,029	
June 25	2,537.5	1,159.1	1,884	500.4
June 30	2,107.6	1,136.0	1,739	
July 5	1,805.9	1,081.9	1,149	
July 10	1,591.4	1,020.2	849	
July 15	1,552.5	925.5	684	
July 20	1,341.3	860.0	674	181.6
July 25	1,244.2	755.6	554	
July 30	1,224.3	731.9	554	
August 5	1,108.2	632.2	557	
August 10	1,036.9	573.4	562	
August 15	993.6	547.5	462	
August 20	997.7	512.3	417	34.0
August 25	938.4	470.5	438	
August 30	905.2	442.8	553	
September 5	813.2	399.7	508	
September 10	938.9	352.7	588	61.5
September 15	864.6	334.7	603	

Tables and diagrams give the amount of water used for irrigation purposes and the area irrigated. From these it is estimated that "the irrigating duty of water in Cache Valley during the month of June, 1896, was 52 acres for each second-foot of water diverted; for July, 67 acres; for August, 113 acres, and for September, 166 acres; the average from June 15 to September 15 being 99½ acres per second-foot."

The value of a bacteriological examination of water from a sanitary point of view, E. K. DUNHAM (*Jour. Amer. Chem. Soc., 19 (1897), No. 8, pp. 591–605*).—It is stated that a large proportion of the bacteria in reservoir water are derived from the air and are strictly aerobic. Gelatin cultures made in air and in hydrogen furnish a means of determining the number of such organisms present. Examinations for *Bacillus coli communis* furnish a means of detecting contamination with human feces. For detecting this organism the putrefaction test based upon Schardinger's method[1] is recommended. It is claimed that a combination of these two tests gives a method of examination which "is better calculated to give a just estimate of the fitness of a water for drinking purposes than the methods in more common use." This claim seems to be borne out by the results of a number of trials of the method on water from different sources.

Alkali in the Rio Grande and Animas Valleys, A. GOSS and H. H. GRIFFIN (*New Mexico Sta. Bul. 22, pp. 21–52, fig. 1*).—This bulletin discusses the formation, kinds, and composition of alkali, surface accumulation of alkali, injurious effects of alkali, and remedies. Analyses are given of 3 samples of alkali from the Rio Grande Valley and one

[1] Centbl. Bakt. u. Par., 16 (1894), p. 833.

from the Animas Valley, and accounts are given of experiments with the "white sands" (gypsum) as a corrective of the alkali.

"The white sands are a very remarkable deposit of practically pure gypsum in a finely granular form, lying about 30 miles to the northeast of the Organ Mountains. This gypsum, being finely divided, drifts before the wind like sand and is piled up in hillocks, often 20 or 30 feet high. It covers a section of country probably 20 by 30 miles in extent. These hillocks of snowy whiteness are visible for miles and present a very striking appearance. The fact that a large number of different plants are found growing right in this deposit is perhaps as good evidence as could be secured of its noninjurious effect on plants."

The experiments with gypsum in the Rio Grande Valley were made on twentieth-acre plats, but only negative results were obtained. The alkali in this region is of the white class and is, therefore, not benefited by the application of gypsum.

Experiments with Animas Valley alkali soil were made in pots. The alkali of this soil is what is known as black alkali and the application of gypsum was very beneficial. The alkali spots of the Animas Valley are known as chico soils because the chico plant (*Sarcobatus vermiculatus*) and saltbush appear to be the only kind of vegetation that will grow on them. Analyses of the chico plant and the Australian saltbush are given. In the first the percentage of ash was 13.12, while in the saltbush it was 27.09. In each case the ash contained large quantities of sodium salts, which are the principal constituents of black alkali.

'One of the most serious dangers from alkali in the Animas Valley is the swamping of low-lying sections by seepage from leaky ditches. The irrigating canals for the valley are taken out of the river and carried along the line of the foothills, sometimes at considerable elevation above the land. The foothills are composed of loose drift material in which it is next to impossible to make canals which will not leak badly. Nearly all the land of the valley, in fact, is very open and porous, being sandy in character.

"As a result of these conditions, the alkali is being washed out of the higher land and carried to the lower lying land where, when the water table comes near enough to the surface for the water to be raised by capillary attraction, the alkali is brought to the surface and deposited there. Numbers of formerly productive fields are already being ruined in this way, and in our opinion the trouble will grow worse rather than better."

An analysis of the Animas River water is reported, which shows that the percentage of soluble salts in this water is very low, and it may therefore be safely used for irrigation purposes.

The physical effects of various salts and fertilizer ingredients upon the soil as modifying the factors which control its supply of moisture, J. L. Beeson (*Jour. Amer. Chem. Soc., 19 (1897), No. 8, pp. 620–649, figs. 3*).—Acting upon the suggestions of Whitney[1] and Hilgard[2], the author has attempted to determine which salts affect the physical properties of soils to the greatest extent, which build up and which break down soil aggregates, with a view to establishing the factors which control their water supply. Descriptions are given of 2

[1] Maryland Sta. Bul. 21 (E. S. R., 5, p. 162).

[2] Agr. Sci., 6 (1892), pp. 321, 566.

forms of apparatus devised by the author to determine the rate of absorption, maximum and minimum water-holding capacity, percolation, and capillary rise of water in soils. One form of apparatus (with which the results here reported were obtained) has already been described in the Record (E. S. R., 7, p. 569). The improved apparatus described consists of 2 soil tubes, with ground end held together by a wide rubber band. Each of these tubes is of 2 sq. in. cross section and holds exactly 100 cc. The lower tube is provided with a perforated removable bottom. To prevent suction a small side tube enters the soil tube just below the perforated bottom. The burette arrangement for supplying and measuring the water is substantially as in the earlier apparatus.

The experiments reported were made with dark alluvial soil from the Mississippi River bottoms, which contained 31.99 per cent of clay and 43.73 per cent of fine silt. The soil was dried and pulverized before use.

The rate of saturation was determined as follows:

"Fifty grams of soil was placed in the soil tube and the burette raised so as to bring the water in contact with the soil. It was allowed to remain there for one minute, then the burette was lowered for one minute and the amount absorbed read off. This process was repeated each minute until the absorption became very slow, when the water was allowed to stay in contact with the soil for a longer period. Then the burette was lowered and left down until the reading was constant."

In the first experiments the soil was used alone or mixed with 0.5 per cent of potash as muriate of potash or nitrate of potash. In all cases the rate of absorption was rapid at first but gradually decreased as saturation was approached. The stratum of capillary moisture rapidly rose to the top of the soil and was slowly followed by one of saturation. These movements, as well as the rate of absorption, were decidedly decreased by the potash salts added. The time of complete saturation was further noted on samples of soil to which had been added 0.5 per cent K_2O as sulphate, chlorid, nitrate, phosphate (K_3PO_4), neutral and acid carbonate, and hydroxid; 0.75 per cent of CaO as caustic lime, sulphate, nitrate, chlorid, phosphate ($CaH_4(PO_4)_2+CaH PO_4$) and carbonate; 0.5 per cent of MgO as caustic magnesia, sulphate, nitrate, chlorid, and carbonate; and 0.1 and 0.5 per cent of Na_2O as acid carbonate, chlorid, and sulphate; 0.1 per cent of nitrogen as ammonium sulphate, chlorid, and nitrate, and nitrate of soda; 0.001 per cent of nitrogen as nitrate of soda; 1, 3, and 9 molecules of CaO+1 molecule of nitrate of soda, and 1 molecule of sodium sulphate+1 molecule of calcium sulphate.

Almost every salt had some effect on the rate of absorption. Most of them decreased it, in some cases to an enormous extent. The lime salts, however, with the exception of the phosphates and carbonates, increased it to a slight extent. The alkaline salts of potash (with the exception of carbonate), ammonium, and sodium in the order named had the most marked effect in decreasing the rate of absorption. In quantities usually applied in practice, however, this effect would be insignificant except in the case of sodium nitrate which, applied at the rate of 0.001 per cent, decreased the rate of absorption 30 per cent. Moreover, in fertilizers as ordinarily applied it is probable that the salts which increased the rate of absorption would neutralize the effect of those which decrease it. The author is of the opinion that variations in the surface tension of the soil water due to different salts "are too small to affect very appreciably the soil's supply of moisture." The arrangement of soil particles under different conditions and the factors which affect it are discussed at some length.

The water-holding capacity of the soil under the different conditions was tested, but the differences observed were so small and irregular that the results are not reported.

The percolation of water through the soil was determined on untreated soil and that which had received 0.5 per cent of muriate and nitrate of potash, 0.75 per cent of lime (CaO) and 0.1 per cent of sodium carbonate. The method used was as follows:

"Fifty grams of soil was placed in the soil tube (of 1½ inches in diameter) saturated with water, and a head of 1 in. of water added on top of the soil, so gently that the water was not muddied, and the time required for 5 cc. to pass through was noted. The next day 1 in. head of water was added again and the rate of percolation noted, and so on until the rate became nearly constant."

The results show that in untreated soil the rate of percolation decreased gradually until it reached 9.6 cc. per hour on the fifth day. In the soil to which 0.5 per cent of potassium chlorid and potassium nitrate were added the rate of percolation was reduced at first to one twenty-fifth and one-thirtieth, finally to one twenty-fifth and one ninety-sixth, respectively, of that through the soil alone. In the soil to which lime was added the rate was more than doubled. "In the case of the potassium salts the percolations slightly increased for a time and then decreased until it was practically nil, when the observations ceased."

Percolation through the soil to which lime had been added increased for a time and then decreased until it became constant at 20.4 cc. per hour. The indications were that these changes in the rate of percolation were due to a change in the size of the soil aggregates. Salts which showed the most marked effect in reducing the rate of percolation appeared to puddle the soil.

The effect of allowing water to remain longer than one hour in contact with soil before the rate of percolation was determined was tested on untreated soil and on soil to which had been added in addition to the kinds and amounts of the salts noted above 0.3 per cent of nitrogen as ammonium nitrate; lime (CaO) plus 1 per cent of nitrogen as nitrate of soda; 0.1 per cent of Na_2O as chlorid plus 0.1 per cent of acid carbonate of sodium; sodium carbonate plus calcium sulphate; and 1 molecule of sodium carbonate plus 2 molecules of calcium sulphate.

"All the potassium salts used reduced the rate of percolation, the nitrate and chlorid having the greatest effects; the nitrate, chlorid, sulphate, and calcium hydroxid increased the rate of percolation, the other lime salts having little effect;

the magnesium salts had little effect, except the nitrate, which increased the percolation; the ammonium salts used decreased the rate of percolation much more than the potassium salts; the sodium carbonate and chlorid, and especially the nitrate, had a remarkable effect in reducing the rate of percolation. One-tenth per cent of soda as sodium chlorid reduced the rate of percolation to one-tenth, and 0.1 per cent of nitrogen as sodium nitrate reduced it to one-twentieth of the rate through the soil alone. . . .

"It is believed that the quantities of these salts which it is practical to add to the soil would be sufficient to make a great difference in the escape of the water of the soil by percolation, and therefore in the amount of water which a soil so treated can maintain for the growth of a crop.

"The soil in which there was a great reduction in the rate of percolation, due to the presence of certain salts, in each case had the appearance of being puddled, which it undoubtedly was. Slaked lime had the greatest effect in increasing the rate of percolation, which agrees with the common experience of the farmer that lime makes the soil more open and porous. Molecular quantities of lime added to the soil to which sodium nitrate (0.1 per cent nitrogen) had been added did not restore its permeability, nor did 3 times the molecular quantity do so. Nine times the quantity increased the permeability to about one-third more than that of the soil alone. . .

"After determining the rate of percolation in a sample it was allowed to freeze in the soil tube, and after thawing the vacant space all around between the soil and the soil tube was filled in with melted paraffin. The rate of percolation was then determined and was found to be a little more than double that of the soil below freezing. After this experiment enough sodium carbonate was added to the water remaining on top of the soil to give 0.5 per cent sodium oxid, and the next day the rate of percolation was determined and was found to be reduced to the extremely low figure of 0.2 cc. per hour."

These results are briefly discussed in their bearing upon alkali soils, and the following quick method of determining the amount of gypsum necessary to correct the puddled condition of alkali soils is suggested:

"Determine the rate of capillary rise, rate of saturation, rate of percolation, rate of evaporation, etc., in those semialkali soils which are yielding the best crops, then by adding constantly increasing quantities of the gypsum to samples of soil from the alkali spots to be treated the quantity required to bring the soil back to the standard may be determined to a close approximation. In this way the needs of the soil would be indicated without waiting for a year of experimentation with a crop."

"*The rate of evaporation* was determined by placing 25 grams of the sample of soil to which the various salts had been added in flat dishes of equal size, to each of which enough water was added to saturate the soil, when they were weighed, set aside for evaporation to take place, and weighed each day. The dishes were shallow and the soil was about three-fourths of an inch deep." In these experiments untreated soil and soil treated with 0.5 per cent of K_2O and MgO and 0.75 of CaO in different forms were used.

"Potassium nitrate and potassium chlorid exerted the greatest influence in retarding both the rate of evaporation and the rate of capillary rise in the soil, and magnesium oxid and magnesium carbonate increased these two factors most. As a rule those compounds which affect evaporation most affect the rate of capillary rise, and in the same direction. The calcium superphosphates and the potassium carbonates are exceptions to this general rule. The hygroscopic nature of some salts would have some effect in retaining moisture *per se*, and independent of any modification of the arrangement or of the size of the soil particles or of the surface tension of the soil water. The results, however, show no changes which are proportional to the hygroscopicity of the salts used. In the untreated soil the capillary rise reached its limit at 50 in. in 110 days, in the soil plus gypsum 51 in. in 68 days, the soil plus calcium carbonate 50 in. in 72 days, soil plus calcium superphosphates 51 in. in 105 days, soil plus magnesium oxid 47 in. in 80 days, and soil plus magnesium carbonate 47 in. in 70 days. The soil column containing potassium sulphate was still rising when it reached the end of the tube at 60 in. in 140 days. This is an increase of 5 in. in height over that in the untreated soil. It is most probable that those salts, such as potassium chlorid and potassium nitrate, which reduced the rate of rise more than potassium nitrate, would also have increased the height of lift more than did the potassium sulphate. It seems to be a general rule, then, that those salts which, when added to a soil, reduce the rate of rise of capillary moisture increase the height of lift; and conversely that those salts which increase the rate of rise decrease the height of lift. These variations in rate and height of capillary lift and in rate of evaporation do not correspond to the changes in the surface tension of water caused by these salts, as was found to be true in the study of the rate of saturation and percolation."

The author considers it desirable, in order to save time, to develop an empirical formula for calculating the height of lift, and states his intention to attempt to work out such a formula.

The results of the above experiments show in general that most of the salts in the amounts usually applied in agricultural practice would have little effect upon the soil supply of moisture. Carbonate, chlorid, and nitrate of soda, however, may be utilized with decided effect as a means of increasing the soil's capacity for storing up and retaining moisture.

It is believed that by means of the method of studying the physical properties of soils here described positive information concerning the moisture needs of a soil and the kind of crop best adapted to it may be obtained without the necessity of waiting a year for the results of field experimentation. It is suggested that the stations might profitably study the subject of fertilizing soils with reference not only to their needs of plant food, but also to their moisture requirements.

Water purification, T. B. CARPENTER (*Albany Med. Ann., 1897, No. 3–4, pp. 141–161*).

Methods for preventing the pollution of water, E. K. DUNHAM (*Albany Med. Ann., 1897, No. 3–4, pp. 162–167*).

Common causes of the contamination of drinking water, T. M. CHEESEMAN (*Albany Med. Ann., 1897, No. 3–4, pp. 115–121*).

On the movement of water in the soil, D. KITAO (*College Agr. Tokyo, Bul., vol. 3, No. 1, p. 113*).—The mathematical features especially of this subject are elaborately worked out.

On the surface temperature of the soil, H. DE VARIGNY (*Jour. Soc. Agr. Brabant-Hainaut, 1897, No. 24*).

On the dialysis of alkaline humates, J. DUMONT (*Jour. Soc. Agr. Brabant-Hainaut, 1897, No. 22*).

Investigations on the changes in volume of different kinds of soil, E. WOLLNY (*Forsch. Geb. agr. Phys., 20 (1897), No. 1, pp. 1–52, fig. 1*).—This article discusses at length the results of experiments on the influence of tillage and wetting and drying on the volume of soils of different chemical and physical character.

Reclaiming barren lands (*Forest Leaves, 6 (1897), No. 5, pp. 93–94*).—An account is given of the attempt made to reclaim the barren lands near Provincetown, Massachusetts.

The deforestation of mountains as related to the fertility of the soil, P. CASAEI (*Jour. Hyg., 22 (1897), No. 1086, p. 333*).—A memoir presented to the Société Agraire de Bologne, April 25, 1897.

FERTILIZERS.

Experiments on the fertilizing action of the phosphoric acid of bone meal, J. KÜHN (*Fühling's landw. Ztg., 46 (1897), No. 16, pp. 471–482*).—Comparative tests of superphosphate (total phosphoric acid 16.96 per cent, soluble 14.03 per cent), Thomas slag (phosphoric acid 20.07 per cent), and "degelatinized" bone (phosphoric acid 29.45 per cent, nitrogen 1.22 per cent), and steamed bone (phosphoric acid 21.99 per cent, nitrogen 4.85 per cent), on summer rye grown in zinc boxes filled with poor sandy soil are reported. These boxes were 20 cm. square and 25 cm. deep and were provided with suitable devices for securing proper aeration and watering. The amount of water added at any one time never exceeded 70 per cent of the water-holding capacity of the soil. The results are summarized in the following table:

Comparison of different forms of phosphoric acid for summer rye.

The fertilizing.[1]	Air-dry crop,			Crop increase, taking the plat receiving no phosphoric acid as 100.		
	Grain.	Straw and chaff.	Total crop.	Grain.	Straw and chaff.	Total crop.
	Grams.	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*
Without phosphoric acid	8.64	22.43	31.07	100	100	100
44.53 lbs. phosphoric acid per acre in form of superphosphate	9.94	25.31	35.25	115	113	113
89.06 lbs. phosphoric acid per acre in form of superphosphate	12.50	30.09	42.59	145	134	137
89.06 lbs. phosphoric acid per acre in form of Thomas slag	13.94	33.72	47.66	161	150	153
178.13 lbs. phosphoric acid per acre in form of Thomas slag	15.46	38.62	54.08	179	172	174
89.06 lbs. phosphoric acid per acre in form of degelatinized bone meal	14.21	36.05	50.26	164	161	162
44.53 lbs. phosphoric acid per acre in form of steamed bone	12.50	33.58	46.08	145	150	148
89.06 lbs. phosphoric acid per acre in form of steamed bone	13.67	32.80	46.47	158	146	150
178.13 lbs. phosphoric acid per acre in form of steamed bone	15.18	35.41	50.59	176	158	163
356.27 lbs. phosphoric acid per acre in form of steamed bone	15.29	35.79	51.08	177	160	164
89.06 lbs. phosphoric acid per acre in form of steamed bone meal, deeply applied	13.31	31.28	44.59	154	139	144

[1] On all plats nitrogen was applied in the form of sulphate of ammonia at the rate of 71.25 lbs. per acre, allowance being made for the nitrogen of bone according to Wagner's figures; potash in the form of kainit, 89 lbs. per acre; and lime in the form of powdered chalk about 810 lbs. per acre.

The results show in general that the Thomas slag and bone meal were about equally effective and gave better results than the superphosphate. The degelatinized bone meal was apparently as effective as the other kind used. The depth at which the steamed bone was applied did not appreciably affect the results, but it is explained that this may be due to the fact that in the soil used the aeration was very good and the meal decomposed with sufficient rapidity to supply the demands of the crop. On heavier or wetter soils the results might be quite different.

The author states that if these results are confirmed by further experiments an extended field for the profitable use of one of the cheapest sources of phosphoric acid, degelatinized bone meal, will be opened up; for it appears to be as effective as the best forms of phosphoric acid on sandy soils and may largely replace Thomas slag on such soils.

Composition of ashes of different woods, A. E. SHUTTLEWORTH (*Ontario Agl. College Rpt. 1896, pp. 24–26*).—Analyses of ashes of the woods of various trees and small fruits made in the laboratory of the college during the year are reported as follows:

Analyses of the ashes of the wood of Canadian trees and small fruits.

Varieties.	Potassium oxid.	Sodium oxid.	Phosphoric acid.	Calcium oxid.	Magnesium oxid.	Iron oxid.	Sulphuric acid.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Blackberry, canes	10.34	....	7.26	35.14	....	....	1.24
Strawberry, whole plant	15.90	....	9.17	17.44	....	....	4.58
Gooseberry, branches	13.07	0.49	6.99	20.64	2.61	1.08	2.01
Raspberry, canes	7.90	.81	6.54	23.03	8.54	1.19	2.60
Grape, whole plant	8.33	....	3.38	26.74	....	....	1.39
Maple, hard, trunk of large tree	9.31	....	2.03	45.24	....	....	1.14
Maple, soft, trunk of large tree	9.52	....	1.29	41.97	5.38	.12	1.39
Ash, black, trunk of large tree	25.30	4.22	1.20	49.04	7.42	.22	.71
Hemlock, trunk of large tree	8.73	3.88	2.76	45.83	4.78	.36	.98
Pine, trunk of large tree	11.22	8.44	4.03	20.28	6.53	1.52	5.85
Cedar, trunk of large tree	3.30	3.08	.98	49.06	2.49	.70	.77
Ironwood, trunk of large tree	8.15	4.95	1.71	42.61	5.63	.50	.79
Oak, trunk of large tree	9.39	2.88	1.69	43.54	4.39	.25	.91
Birch, trunk of large tree	8.58	1.47	1.81	37.10	5.65	.39	1.90
Elm, trunk of large tree	35.37	Trace.	.45	23.64	6.48	.19	Trace.
Beech, trunk of large tree	7.58	4.09	1.39	41.21	6.16	.30	Trace.
Spruce, entire small tree	8.98	.15	4.00	25.82	4.04	1.52	2.61
Willow, trunk of large tree	9.59	1.51	2.16	35.55	3.21	.55	2.38
Apple, entire tree	4.84	4.02	1.81	44.93	3.28	.70	.41
Ash, white, trunk of large tree	16.88	12.90	.93	37.14	3.98	.32	.67
Balsam, trunk of large tree	17.53	1.54	2.39	22.63	4.04	1.08	.88
Basswood, trunk of large tree	9.39	.10	5.28	33.42	4.28	.44	Trace.
Poplar, trunk of large tree	10.42	1.76	2.98	28.38	4.54	.36	Trace.

The rational use of fertilizers as shown by agricultural charts, J. COQUILLION (*Emploi rationelle des engrais révéle par les cartes agronomiques à l'usage des agriculteurs, des instituteurs chargés de l'interpretation de ces cartes. Dijon: Rey, 1897, pp. 71*).

Recent observations on the use of potash fertilizers, A. DAMSEAUX (*Agr. Rationelle, 1897, No. 9*).

The value of manure from animals fed on linseed meal, H. SNYDER (*Minnesota Sta. Rpt. 1896, pp. 23, 24*).—Reprinted from Bulletin 47 of the station (E. S. R., 8, p. 575).

The rational management of barnyard manure, J. H. VOGEL (*Die rationelle Behandlung des Stallmistes. Dresden: G. Schönfeld, 1897, pp. 20*).

Phosphatic fertilizers, G. SMETS (*Les engrais phosphatés, De phosphaat-mesten. Maaseyck: Vanderdonck-Robyns, 1896, pp. 24*).

Precipitated phosphates, A. PETERMANN (*Jour. Soc. Agr. Brabant-Hainaut, 1897, No. 22*).

On the action of phosphoric acid as a fertilizer, A. ROSSEL (*Mitt. naturf. Gesell. Bern, 1896, p. 12*).

On an important observation concerning ignited Thomas phosphate, M. SCHMOEGER (*Landw. Vers. Stat., 48 (1897), No. 6, pp. 413-418*).—Thomas phosphate ignited with silica increased in citrate solubility; by simple heating of the phosphate the citrate solubility was in some cases increased, in others decreased.

On ground bone, TANCRÉ (*Landw. Wochenbl. Schleswig-Holstein, 47 (1897), No. 37, p. 525*).

Nitrate of soda vs. sulphate of ammonia, J. J. WILLIS (*Gard. Chron., 3. ser., 22 (1897), No. 552, pp. 46, 47*).

Poisoning of plants by nitrate of soda, P. SCHMIDT (*Landw. Centbl. Posen, 25 (1897), Nos. 28, p. 173; 29, pp. 178, 179*).—Recommendations to German farmers regarding the purchase of nitrate of soda based on the work of Sjollema and others.

Nitrogen manuring with special reference to the more important nitrogenous fertilizers of commerce (sulphate of ammonia and nitrate of soda), O. REITMAIR (*Ueber Stickstoff-Düngung; mit besonderer Berücksichtigung der wichtigsten Stickstoff-Dünger des Handels (schwefelsaures Ammoniak und Chilisalpeter). Vienna: Wilhelm Frick, 1897, pp. 24*).

Analyses of fertilizers, C. A. GOESSMANN (*Massachusetts Hatch Sta. Bul. 48, pp. 24*).—Tabulated analyses of 177 samples of fertilizing materials, including ashes, muriate of potash, sulphate of potash, kainit, bone, tankage, mineral phosphate, cotton-seed meal, tobacco refuse, muck and soil, guano, and mixed fertilizer. The variation in composition of ashes is discussed and comments are made on the fertilizing value of some of the other fertilizing materials analyzed.

Phosphate manuring with special reference to the more important phosphatic fertilizers of commerce (superphosphates and Thomas slag), O. REITMAIR (*Ueber Phosphorsäure-Dünger mit besonderer Berücksichtigung der wichtigsten Phosphorsäure-Dünger des Handels (Superphosphat und Thomasschlacke). Vienna: Wilhelm Frick, 1897, pp. 24*).

Box experiments with phosphates, L. H. MERRILL (*Maine Sta. Bul. 34, pp. 8, fig. 1, dgm. 1*).—This is a brief popular summary of results of experiments given in detail in the Annual Report of the station for 1895, p. 10 (E. S. R., 8, p. 757).

Experiments on the action of the phosphoric acid and nitrogen of peat and excreta mixture and poudrette, M. MAERCKER (*Mitt. deut. landw. Gesell., 12 (1897), No. 16, p. 203*).

Experiments with samples of poudrette which had been treated with different amounts of sulphuric acid, M. MAERCKER (*Mitt. deut. landw. Gesell., 12 (1897), No. 14, p. 194*).—Nitrogen of poudrette treated with sulphuric acid was more effective than that of poudrette not so treated. Doubling the amount of sulphuric acid produced no perceptible increase in the availability of the nitrogen.

Fertilizer inspection, C. D. WOODS (*Maine Sta. Bul. 33, pp. 16*).—This bulletin gives the text of the State fertilizer law, a schedule of trade values of fertilizing ingredients for 1896, with notes on valuation and tabulated analyses of 105 samples of fertilizing materials.

Citrate solubility of Thomas slag, H. DUBBERS (*Chem. Ztg., 21 (1897), No. 66, p. 654*).—Quotes Petermann in Bul. Sta. Agron. Gembloux, 1897, No. 61, in opposition to the selling of this fertilizer on the basis of citrate solubility instead of on the basis of total phosphoric acid and "fine meal."

Citrate solubility of Thomas slag, ULLMANN (*Chem. Ztg., 21 (1897), No. 70, p. 700*).

FIELD CROPS.

Manurial conditions affecting the malting quality of English barley, J. M. H. MUNRO and E. S. BEAVEN (*Jour. Roy. Agr. Soc. England, 8 (1897), 29, pp. 65-114, figs. 9*).—The article compares barley and wheat culture in England, describes desirable qualities of barley for malting purposes, and considers the effects of manures on these qualities.

The 2 subspecies, *Hordeum distichum* and *H. hexastichum*, are described, and the countries from which they are imported by English brewers and maltsters are mentioned. It is stated that the importation of varieties of *H. distichum* depends mainly on its price and the supply of good barley of this kind grown in England, but that aside from these factors varieties of *H. hexastichum* are used because they contain "about 10 per cent more of insoluble matter, husk, etc., than Chevalier barley malt and can be much more close-crushed and yet give good 'drainage' in the mash tun," and that "it is generally modified in the malting process in a somewhat different manner from English barley and yields an extract which, though less in quantity, is in some important respects and for some descriptions of brewing better in quality than we get by the lower qualities of English two-rowed barley in most seasons."

A number of opinions of scientists and practical agriculturists as to the effects of manures on the quality of malting barley are given, and the requirements of the maltster in respect of such qualities in barley as are likely to be affected by cultural conditions are considered. A few propositions bearing on the question of "quality" in barley are laid down as follows: "First, it is the endosperm and mainly the starch of the endosperm which is the source of the brewer's raw material. Secondly, the grain which has the largest proportion of endosperm to embryo will, other things being equal, yield as malt the most extract to the brewer. This is usually the largest-bodied grain, that is to say, a sample of barley of which 1,000 individual corns weigh 50 gm. will have a higher proportion of endosperm to embryo and therefore a higher starch percentage than a sample of which 1,000 corns weigh only 30 gm. Size of corn, then, mainly determines the quantity of brewer's material yielded by a given bulk of barley. Thirdly, the modification desired by the maltster is the same as the first stage of that modification which in the ordinary course of nature the seed would go through in germinating, and it is very largely the degree of amenability of the endosperm to modification during malting that differentiates good from bad malting barley. Amenability to modification depends very much on the state of maturation of the grain."

The maltsters work is described as converting starch into a suitable condition for the brewer's use, and to sufficiently conserve and produce the soluble ferments, such as the diastase and others necessary in the brewing process. Attention is called to the fact that the object of the maltster is simply to break down the cell walls of the endosperm and thus to liberate the starch granules, and although some sugars are formed in the malting stage the process is carried on only to set the starch free, converting as little as possible into sugar. The process is starch liberation and not starch conversion as is commonly but erroneously supposed. "A grain in which the cell walls inclosing the starch break down easily and quickly is said to be free working and a grain of which the reverse is the case is said to be stiff working," and this condition is found to depend upon the "maturation" of the grain. A rather low temperature which lengthens the ripening period, and certain atmospheric conditions between cutting and harvesting which increase the mellowness of the grain, are considered preferable.

Tests of good "maturation" by means of an instrument known as Pohl's "Kornprüfer" are described. With this instrument the grains are cut transversely and the fractured surfaces left exposed upon withdrawal of the knife. By magnifying these surfaces the degree of "maturation" is ascertained. The hard or "steely" grain seems to show the cell walls inclosing the starch granules while in grains ripened under more favorable circumstances a mealy homogenous surface is presented which is believed to indicate that the starch-containing cells have been ruptured. "The matter of importance is that this difference corresponds with the difference in the capacity of the endosperm to modification in malting." The ways in which over-ripening, over-exposure in bad weather, drought, and close thrashing may reduce the malting value of barley are explained, but the opinion is expressed, however, that recently the most serious defect of English barley has been deficient maturation.

Concerning the chemical composition it is stated that "in addition to starch, and a small quantity of ready formed sugars, barley contains other carbohydrates, probably intermediate between sugar and starch. . . . The proportion of nitrogenous matter to starch varies in barley with different conditions somewhat differently from what it does in wheat, but there is a general tendency in the same direction, and the mellower barleys are usually the less nitrogenous ones."

The article gives a detailed consideration of the experiments performed at Rothamsted to ascertain the effect of different manurial conditions on the malting quality of barley. The treatment of each field and the results are described, and the records relating to the quality of the produce are given. From the evidence it is concluded that potash salts are only likely to affect the quality of the grain where the soil has been previously exhausted of potash. Regarding the influence of phosphoric acid it is quoted from Sir Henry Gilbert that phosphatic manures on Rothamsted soils almost invariably have a favorable influence on the malting quality of the grain. The authors believe that results from the Rothamsted plats show that different manurial conditions affect the malting quality of barley in as much as they affect the "maturation" of the grain, and that when they increase the crop the improvement in "maturation," or the reverse, is much affected by atmospheric conditions.

Another set of experiments for this purpose was conducted on the Warminster plats. The results obtained in the experiments at both places and the value of the malt from grain grown on the various plats are given in tabular form for comparison. In the Rothamsted experiments the diastatic value was highest in the barley from the barnyard manure plat and in the malt obtained from it. It has been shown that diastase is present where the starch is in the least favorable condition for modification, and as the grain from the barnyard manure plat was least matured the reason for the high disastatic value is believed to be explained. A better range of results was obtained from the Warminster than from the Rothamsted plats, which is attributed to the character of the soil. The low quality of the barley from a certain plat and of the corresponding malt is attributed to the lodgment of the crop, which was indirectly the result of manurial conditions.

The authors conclude that all of the investigations undertaken have led to the confirmation of the statement that "conditions affecting malting quality are bad or good just in proportion as they affect maturation."

Methods of curing clover and alfalfa, M. Maercker (*Braunschweig. landw. Ztg.*, 45 (1897), No. 34, pp. 151, 152).—The author compares the methods of curing clover and alfalfa in the field and on the drying rack. The racks are described and explanations of how to use them are given. The advantages of curing on the rack during wet weather are pointed out.

One-half of a field of 4½ hectares of alfalfa was cured in the field and the other half on racks. Three cuttings were made during the season. The rack method of drying produced 1,644 kg. more hay per hectare than the other method of curing. Calculations based on analyses show that the rack-dried hay contained 128 kg. crude protein, 629 kg. nitrogen-free extract, and 1,183 kg. of dry matter more than hay cured in the shock on the field. Field curing is considered detrimental to the following growth, as the shocks necessarily retard growth on the ground occupied by them.

The author concludes that the increase in yield warrants the practice of rack drying, although somewhat more expensive.

Results of experiments with corn, cotton, forage crops, and tobacco, D. N. Barrow (*Louisiana Stas. Bul. 47, 2. ser., pp. 104–124*).—A comparison of 20 varieties of corn was made in connection with fertilizer tests. Farmers Pride produced the largest crop, 35.3 bu. per acre, followed by Creole with 33.4 bu., and Mosby Prolific, Madison and Champion White with 32.1 bu. each. The yields are considered small but comparative. The results are tabulated.

Drought interfered with the fertilizer tests with corn, cotton, and sugar cane and conclusive results were not obtained but the results are given.

Alfalfa and crimson clover grown on bayou bottom land were destroyed by the floods, while Italian rye grass, orchard grass, and red top were injured by the dry weather. Red clover, rescue grass, and Texas blue grass are reported as making good growth. Rescue grass and Texas blue grass are considered very desirable for winter pasturage.

Variety tests and fertilizer experiments with tobacco are tabulated and notes on curing and fermentation are given. The result of variety tests of cotton and forage plants are given in tables.

Experiments with varieties of grain, C. A. ZAVITZ (*Ontario Agr. Col. and Expt. Farm Rpt. 1896, pp. 122–149*).—During the past 8 years all varieties obtainable in Canada and many leading sorts obtained from Egypt, Japan, the United States, and the principal countries of Europe were tested.

Forty-four selected varieties of barley were sown in 1896. Vermont, Champion, and Jarman Selected Beardless yielded the heaviest grain. Mandscheuri (seed obtained from Russia) yielded on an average for 7 years 66.3 bu. per acre. The varieties which gave the greatest length of straw were Kinnakolla (39 in.), New Zealand Chevalier (36 in.), and the Mandscheuri (35½ in.). Success, Four Rowed, Northwestern, and Manitoba Six-rowed matured first, the Mandscheuri and Oderbrucker being about 3 days later. Among the hulless varieties Guy Mayle and Smooth Hulless yielded the best average for 4 years, 47.23 and 43.94 bu. per acre, respectively. On a number of plats barley was sown broadcast and in drills on different dates. Broadcasting on April 22 produced the best yield and, taking the average of the whole experiment, drilling produced 3.6 bu. per acre more than broadcasting.

Among 46 new domestic and foreign varieties of peas, White Wonder, Early Briton, and Field were the most productive. White Wonder, imported from New Zealand, is very promising. Egyptian or Brazilian Coffee pea and Grass pea were completely free from injury by the weevil.

Bart Tremenia and Herison Bearded stand first in productiveness among 48 varieties of spring wheat. Drilling and broadcasting on April 18 and 22 and May 1, 9, 18, and 25 resulted in a larger yield and heavier grain from the drilled plat sown on April 18.

A test of 95 varieties of oats showed Joanette, a French variety, and Siberian, a variety obtained from Russia, the most promising. The average height of the former was about 40 in., while that of the latter was about 50 in. Drilling gave better results than broadcasting, and April 26 was found to be the best date for sowing.

For 4 years oats, wheat, barley, and peas were grown separately and in various combinations for the production of grain and straw. In 10 cases out of 11 the grain grown in mixtures gave larger yields than the same kinds grown separately. Mixtures of peas and oats, and peas, wheat and oats gave the largest yield of straw in the average of the 4 years' test. Large plump, small plump, shrunken, and cracked grains of wheat, oats, and barley were used as seed. The largest yields and largest kernels were obtained from the large plump seed. Sowing barley, spring wheat, and oats on April 21 gave better returns than sowing on other dates. Drilling was more profitable than broadcasting.

Silage and forage crops, C. A. ZAVITZ (*Ontario Agr. Col. and Expt. Farm Rpt. 1896, pp. 182–202*).—This is a report of experiments with corn, millet, rape, sunflowers, grasses, clovers, and miscellaneous crops.

One hundred and thirty-six varieties of corn were tested for fodder, silage, and grain. Of the 53 varieties under trial for 6 years Chester County Mammoth stands first, Brazilian Field second, and Mammoth White Surprise third in average yield per acre. Mammoth Southern Sweet, Wisconsin Earliest, White Dent, and Compton Early, representing the early, medium, and late varieties, were planted to test the effect of distance between plants and rows. The largest total yield of green crop per acre was produced from the plants which were 4 in. apart in the drill and the largest yield of ear corn in every case was produced from the plants which were 12 in. apart in the drill. Seeds from the small end of the ear gave the largest total crop and seeds from the large end of the ear the largest crop of ears. Planting corn 2 in. was better than planting 1 or 3 in. deep. Corn from seed grown in Ontario and from seed grown in the United States gave practically the same results.

Among 8 fodder crops rape was the most productive, and when large, plump seed was used better results were obtained than from the use of smaller seed. Four inches between plants in the drill proved to be the preferable distance. Rape seed planted 2 in. deep gave better results than seed planted 1, 3, or 4 in. deep. Nitrate of soda was more effective than other commercial fertilizers applied to the crops. The rape crop responded readily to subsoiling.

Alfalfa gave more than double the average yield per acre of either sainfoin, Long Red Rawdon, Mammoth Red Perennial, Alsike, Yellow Trefoil, or the common red clovers. Crimson clover has not given favorable results.

In a test of 21 varieties of grass lyme grass (*Elymus virginicus*) produced the heaviest yield of green crop. An experiment with different grass mixtures for permanent pastures was made, and notes on miscellaneous crops are given.

Peas and oats when sown together produced the largest yield of green crop per acre of all the mixtures of peas, oats, wheat, and barley which were sown. Sowing 2 bu. of oats and 3 bu. of peas per acre gave better results than sowing less of either or both.

German or Golden millet on trial for 5 years gave the largest yield of green crop per acre among the varieties of millets tested. Three Japanese varieties recently introduced proved promising.

Soil and forage crop tests at Dover, W. H. BISHOP (*Delaware Sta. Rpt. 1896, pp. 160–163*).—Previous work in this line was published in the Annual Report of the station for 1895 (E. S. R., 8, p. 486). A series of plats, consisting of 3 check plats and 7 others, fertilized with nitrogen, phosphoric acid, and potash, alone and in combinations of 2 and 3, were planted to Chester County Mammoth corn, teosinte, Pearl millet, Long Red mangel-wurzels, Vilmorin Improved sugar beets, Yellow Millo maize, White Millo maize, Brown durra, Red Kafir corn, and White Kafir corn. The results are given in tables.

Teosinte gave a larger yield than any of the other forage crops. Of the plants fertilized with mixtures of manures mangel-wurzels gave the largest yield except in 2 cases, where teosinte exceeded all others. Millo maize produced more forage than the roots on the unfertilized plats and acid phosphate applied to sugar beets in connection with nitrate of soda and muriate of potash was unprofitable. The muriate of potash applied alone was found to be the most profitable fertilizer for sugar beets. The addition of nitrate of soda to muriate of potash as a fertilizer for mangel-wurzels is reported as profitable.

Hops, and the modern requirements of the brewer relating thereto, L. BRIANT and C. H. MEACHAM (*Jour. Roy. Agr. Soc. England, 3. ser., 8 (1897) 29, pp. 56–65*).—The article considers the preparation of hops for brewing purposes with reference to the recently discovered properties of the hop resins.

"The resins separated by Hayduck were 3 in number, distinguished as A, B, and C. The first two he proved to possess an antiseptic action, being particularly unfavorable to the growth of the lactic ferments, yet not to the true yeast of beer. . . . Apart from the question of flavor and aroma, the percentages of these preservative resins in a hop largely determines its value from a brewing point of view. The preservative resins, A and B, are soft or oleo resins; C, the nonpreservative, is a hard resin."

The reasons given for the inferiority of the English as compared with the Continental and American hops are that English hops are usually picked before the resins have sufficiently developed and that the systems of drying are wasteful of the resin substances. It is considered that the increasing demand for pale beers has encouraged the early picking of hops, as the brewer prefers pale hops, being under the impression that ripe hops, which are naturally higher in color than unripe ones, give a deeper tint to the beer. A number of experiments, however, have shown that the impression of the coloring power of ripe hops is to a great extent incorrect. The color imparted to beer by decidedly brown ripe hops was generally very little greater than that of pale unripe hops, provided that brownness was due to ripeness alone. As factors affecting the coloring power of hops, age under ordinary storage conditions, temperature at which stored, percentage of moisture, manner and degree of kiln drying, ripeness, and diseased condition are considered. The statement is made that cold storage will prevent the chemical changes which take place under ordinary storage systems and result in a considerable increase of color in ordinary hops by the time they are one year old. Experiments were made to determine the effect of each of the above-mentioned factors, and the results are given in tables. The following table shows the effect of ripeness:

Ripeness of hops as affecting the color of wort.

	Color of wort by Lovibond's tintometer. (1 in. cell).	Increase of color.
Wort after boiling without hops	11.0	....
Wort after boiling with a very pale Worcester hop	11.5	0.5
Wort after boiling with a very ripe (reddish brown) Hants hop	11.7	0.7

It is recommended to grow the variety of hops best suited to the soil as a certain soil is usually best adapted to a special variety, although under this practice no relief from pressure in picking and drying by planting early and late sorts can be had.

The effects of unfavorable weather are pointed out but no measures are given by which the recognized difficulties may be overcome. The definite ends to be attained are given, but the means to reach them are left to the consideration of the grower.

"Ripe hops when picked and transferred to the oast houses possess their full amount of adhesive, resin-containing, lupulinic powder, though if they have been allowed to hang too long after they are thoroughly ripe they may lose some of their resins." It is stated that under a wrong impression hops are dried at temperatures detrimental to their qualities. The authors found that the moisture of hops when ready to be dried varies from 25 to 75 per cent, and that the reduction of the moisture to 8 or 10 per cent is sufficient to make them keep well. Excessive and unnecessary drying is found to waste the resins, "for the lupulinic powder containing the resins which at first is adhesive to the bases of the petals of the hop becomes increasingly less so as the removal of the moisture progresses."

Hovering and turning the hops during the drying process is considered objectionable as it reduces the resins and consequently the preservative value. "The moisture when hops are packed should be from 8 to 10 per cent." The reasons given are that if the percentage of moisture is higher the hops will not keep, and if much lower the hops are brittle and the cone will be broken up in packing, thus increasing the loss of resin and making the hop unsuitable for some of the brewer's requirements. "A well ripened hop, skillfully dried and carefully managed so as to leave the cones unbroken and in possession of their full value of resins and other qualities," is considered the product which fulfills the modern requirements of the brewer.

Experiments with potatoes and field roots, C. A. ZAVITZ (*Ontario Agr. Col. and Expt. Farm Rpt. 1896, pp. 149–182*).—The work with potatoes consisted of experiments with varieties, depth of planting, treatment against scab, application of fertilizers, preparation and selection of seed, and methods of cultivation. The most productive among 195 varieties tested were Empire State, Burbank Seedling, and Stray Beauty. The average results for six years favored planting 5 in. rather than 1, 3, or 7 in. deep. Considering the amount of seed required, medium-sized whole potatoes planted 1 ft. apart gave a better yield for 5 years than either whole tubers or sets planted 1, 2, or 3 ft. apart.

In a study of the effect of using seed potatoes of different sizes, large, medium, small, and very small potatoes were planted. The experiment was continued for 3 years, each year selecting large seed from the product grown from large seed, medium-sized potatoes from that from medium seed, etc. The yields were approximately in proportion to the size of the seed, the largest yield being obtained from the largest seed. Experiments led to the conclusion that more depended upon the size of the sets than upon the number of eyes. Sprinkling freshly cut potatatoes with plaster and lime increased the yield.

Among 29 varieties of Swedish turnips grown for 6 years Hartley Bronze Top heads the list with an average yield of 20.69 tons per acre. Seventy-four varieties were grown this season. Eight inches between plants and 20 in. between drills were found to be the best distances, and 1 in. the best depth of planting. Among the field turnips Jersey Navet was the most productive. The white variety of field turnips gave larger yields than the yellow varieties. Red Top White Globe produced the largest yield per acre, 35.65 tons.

The results of experiments on mangel-wurzels, carrots, sugar beets, and parsnips are reported.

On the influence of vegetable mold on the nitrogenous content of oats, H. W. WILEY (*Jour. Amer. Chem. Soc., 19 (1897), No. 8, pp. 605–614*).—For 3 years oats were grown in pots on vegetable soils from Florida containing when air-dry over 80 per cent of organic matter and less than 10 per cent of sand and other mineral ingredients. The soils were found to be deficient in potash and phosphoric acid, containing about 0.05 per cent of these ingredients, the potash being found in even smaller quantities than the phosphoric acid.

The soils responded more readily to phosphatic fertilizer than to any other, and finely ground Florida phosphate was easily available to the growing plants. "The soil from the best muck land was found to be entirely free from nitrifying ferments, and cultures seeded with it showed no nitrification after 40 days. The practical absence of nitric acid in the air-dry sample is therefore not surprising. On the other hand, the molds which produce ammonia in an acid soil appeared to be fairly active."

The average percentage of nitrogen in the grain and straw of the plants grown in 1894 was 2.02. A very high content of nitrogen was found in all parts of the crop. On the unfertilized soils the nitrogen content of the plants was greater than that of the plants grown on fertilized soils. It was found that phosphatic fertilizers were very effective in diminishing the nitrogen content of the crop. The crops from 7 pots which had been fertilized with phosphatic fertilizer only had an average nitrogen content of 1.48 per cent in the grain and straw. In connection with nitrogenous fertilizers the phosphatic fertilizers were less effective in the reduction of the nitrogen content. From the results obtained the author concludes that these soils require a phosphatic fertilizer only, and that the 3 forms used in the experiments (Florida phosphate, slag phosphate, and superphosphate) are equally effective. The author states that "these vegetable soils permit of the easy absorption of the finely ground phosphates without previous treatment with sulphuric acid."

In 1895 the experiments were repeated with 12 pots filled with fresh samples of vegetable soils, resembling in their chemical analysis the soils of the previous experiment. The results did not show nearly so high a percentage of nitrogen in the crop as in the previous year, and did not verify the effects of the phosphatic fertilizers.

In 1896 the experiments were again repeated with the soils used in 1895, but without any other application of fertilizer. In this experiment the pots contained nearly twice the amount of soil used in the previous experiments, but with no increase in the surface area. The results indicate in general that phosphatic fertilizers tend to diminish the nitrogen content of the crop. "This diminution in the percentage of nitrogen appears to have resulted chiefly from the increase in the crop and not to any deleterious influence in the phosphatic fertilizer."

A comparison of oats grown on ordinary soils from 6 different States (Missouri, Michigan, Illinois, Wisconsin, Maryland, and the District of Columbia) and those grown on Florida vegetable soils under like conditions was made in 1895 and 1896. The average nitrogen content in the straw and grain of 14 samples grown on common soils was 1.13 per cent in 1895 and 1.04 per cent in 12 samples in 1896, while the 14 samples grown on the Florida soils in 1895 showed an average nitrogen content of 1.30 per cent, and the 12 samples grown in 1896 1.42 per cent.

"When it is remembered that these vegetable soils are extremely rich in nitrogen, . . . and when it is further considered that they are quite deficient in nitrifying ferments, it is fair to conclude that at least a portion of this excess of nitrogen which they contain is assimilated directly from the vegetable mold without previous oxidation to nitric acid."

The author made a comparison of the relative percentage of amid and proteid nitrogen in the crops grown on ordinary soils and those grown on Florida soils, and found the content of the amid nitrogen in the crops from the vegetable soils to be abnormally high, and the content of proteid nitrogen fairly comparable with the content of the proteid nitrogen in the crops from the miscellaneous soils. From the data obtained the author infers that the increase of total nitrogen content of oats grown in the vegetable soils rich in nitrogen is chiefly due to the content of nonproteid nitrogen.

Among others the following conclusions are given: Oats grown upon humus soils contain about 25 per cent more nitrogen than those which are grown on ordinary agricultural soils. Fertilization of humus soils, such as were used in these experiments with potash and nitrogenous fertilizers, did not have any appreciable effect upon the quantity of the crop.

The climatic and cultural conditions of Sweden (*Deut. landw. Presse, 24 (1897), No. 68, p. 613*).—Some facts concerning the climate of Sweden and notes on the culture of wheat, oats, barley, sugar beets, legumes, and grasses.

Sowing on light soils, TANCRÉ (*Fühling's landw. Ztg., 46 (1897), No. 18, pp. 535–538*.—A discussion on the preparation of a seed bed on light soils.

Progress of the several experimental farms in 1896, W. M. HAYS, T. A. HOVERSTADT, W. W. PENDERGAST, and A. BOSS (*Minnesota Sta. Rpt. 1896, pp. 305–341*).—A reprint of Bulletin 50 of the station (E. S. R., 9, p. 131).

The effect of sterilizing soil on the growth of root tubercles of cowpeas, M. H. BECKWITH (*Delaware Sta. Rpt. 1896, pp. 108, 109*).—The plants were grown in pots in a greenhouse on sterilized soils. They made a weak growth and produced no nodules upon the roots.

Catch crops after winter barley (*Braunschweig. landw. Ztg., 65 (1897), No. 36, p. 161*).—A discussion of how lupines and vetches may be grown after winter barley for green manuring.

Catch crops and their culture (*Farm and Home, 16 (1897), No. 812, p. 325*).—Notes on clover and rye grass, mustard and rape, rye and vetches, rye, ox cabbage, and rye grasses.

Fodder crops, J. WRIGHTSON (*Agr. Gaz. [London], 46 (1897), No. 1237, pp. 272, 273*).—Cultural notes on crimson clover, winter rye, and winter vetches.

Principles underlying forage culture, E. GROSS (*Fühling's landw. Ztg., 46 (1897), No. 18, pp. 539–553*).—Notes on forage culture and tabulated results of seed tests.

The culture of some forage plants, THÖMSGEN (*Ztschr. landw. Ver. Hessen, 1897, No. 35, pp. 315, 316*).—Notes on kidney vetch, hairy vetch, serradella, Jerusalem artichoke, carrots, and lupines.

The influence of fertilizer on the quantity and quality of forage, C. DUSSERRE (*Chron. Agr. Canton Vaud, 10 (1897), No. 18, pp. 491–493*).—A report on experiments. The forage from the manured field was richer in nitrogenous matter, carbohydrates, and ash, and a little poorer in fats than the forage from the unmanured field. The manured field produced the largest crop.

The draft of flax on the soil, H. SNYDER (*Minnesota Sta. Rpt. 1896, pp. 3–20, 29, 30, figs. 4*).—Reprinted from Bulletin 47 of the station (E. S. R., 8, p. 586).

The hop crops of the world (*Agr. Gaz. [London], 46 (1897), No. 1236, p. 250*).—The article treats of the hop production in 1897.

Maize growing on scrub lands, A. J. BOYD (*Queensland Agr. Jour., 1 (1897), No. 2, pp. 92–96*).—Notes on clearing the land and directions how to grow and utilize the crop of maize.

Potatoes; variety tests in 1896; potato implements, S. B. GREEN (*Minnesota Sta. Rpt. 1896, pp. 419–440, figs. 12*).—A reprint of Bulletin 52 of the station (E. S. R., 9, p. 128).

Variety tests of rye, N. WESTERMEIER (*Deut. landw. Presse, 24 (1897), No. 69, p. 625*).—Heine's light-colored Zeelander rye produced the largest yield.

Sugar production in the Argentine Republic (*Mitt. deut. landw. Gesell., 12 (1897), No. 16, Suppl., pp. 89–96*).—A discussion of the culture of sugar cane and its natural requirements. The manufacture of sugar as carried on in that country is described.

Manuring for wheat (*Sächs. landw. Ztschr., 45 (1897), No. 34, pp. 481, 482*).

Results of experiments at the San Juan Substation, H. H. GRIFFIN (*New Mexico Sta. Bul. 21, pp. 18*).—This bulletin includes popular notes on the fertilization of sandy soils by leguminous plants, giving the results of growing several varieties of legumes at the substation; results of a successful test of potassium sulphide for the prevention of the loose smut of oats; a verification of the use of corrosive sublimate for the prevention of potato scab; popular and remedial notes on the squash bug (*Anasa tristis*), the Colorado potato beetle, tomato worm, and New Mexico bean bug (*Epilachna corrupta*); and notes on tomato blight, and on the use of Bordeaux mixture for its prevention.

HORTICULTURE.

Report of the horticulturist, M. H. BECKWITH (*Delaware Sta. Rpt. 1896, pp. 83–111*).—An experiment in the subirrigation of tomatoes is noted. At the time the report was made the surface-watered plants gave indications of better results than subirrigated ones, but no complete comparison could be made until the close of the season. Comparative notes are given on 50 varieties of tomatoes.

Bulletin 28 of the station on strawberries is reprinted (E. S. R., 7, p. 766), and notes are given on 62 varieties of strawberries grown in 1896.

An attempt was made to keep grapes fresh by the use of vapor of alcohol. Two bunches of ripe Norfolk grapes were placed under a bell jar with 2 small bottles of alcohol. On December 18, the grapes were plump and sound and had a nearly normal flavor but their color had become somewhat darker brown. On February 10 they were still plump with a few exceptions but had an alcoholic flavor.

To test the relative merits of pruning grapevines before and after the leaves are formed, 2 Concord vines in a row of 12 were pruned after their foliage had started, the others having been pruned before. By the last of June the early pruned vines were much superior to the others in growth, productiveness, and size of fruit bunches.

Report of the working and results of the Woburn Experimental Fruit Farm since its establishment, DUKE OF BEDFORD and S. U. PICKERING (*Woburn Exptl. Fruit Farm, Rpt. 1897, pp. 1–149, 181–492, figs. 7, pls. 7*).—*Description of grounds and experiments* (pp. 1–56).—In this first report of the new fruit experiment station established by the Duke of Bedford, a detailed account is given of the experiments laid out, of the soil, its location, chemical composition, the fertilizers used, etc. The results already obtained, though necessarily incomplete, are thought by the authors to present many features of interest and practical importance. As an indication of what is being done, the principal experiments with apples may be noted as follows: Twenty-two experiments with manures, including kinds and amounts of manure, ways of applying it, etc.; 6 modes of soil treatment; 19 ways of planting trees, 6 ways of arranging them; 16 methods of training trees; 14 modes of branch treatment, and 5 of root treatment. In addition to the above, crossing apples is to be fully studied, and work is to be done on diseases of the apple. The apple collection of the farm includes 117 varieties. Somewhat less extensive experiments have been undertaken with a number of fruits.

Experimental results (pp. 57–149; 181–192).—This part of the report treats at considerable length of methods of making observations, the sources of error, and the results of the experiments. The vigor of growth was determined by estimating the average size of leaves, the total leaf area per tree, the number of new shoots per tree, and the length of new wood formed. The agreement between these different factors of vigor of growth was more general than was anticipated, though they were affected in different degrees by different treatments. The wood growth was affected by beneficial or injurious treatment much more than the leaf size; indeed, except where the special treatment affected the wood growth by nearly 50 per cent, there was usually almost no effect on leaf size.

Careless planting, followed by neglect, gave the most marked effect, in 1893 the growth being only 7 per cent, leaf size 25 per cent, total leaf area 16 per cent, and the following year the fruit only 5 per cent as much as under normal treatment. As to the separate items constituting neglect, in 1894 the leaf size was diminished by the growth of weeds in the orchard 44 per cent, by planting in untrenched ground 17 per cent, by absence of manure 23 per cent, etc. The growth of grass about the trees diminished the leaf size of dwarf apples 35 per cent, and of standards 41 per cent; the wood growth of dwarfs 87 per cent, and of standards 74 per cent; and the crop of fruit of standards 71 per cent. The authors believe that the dry seasons are accountable for the marked effect of grass and weeds on the growth of the trees. Failure to cut back trees when planted lessened the leaf size 24 per cent and the wood growth 83 per cent. No definite conclusions have been reached with regard to summer *vs.* autumn pruning. Trees that were root pruned the first year after planting made 91 per cent less growth than trees that were not root pruned. Autumn planted trees grew much less vigorously than spring planted ones. No very definite results have been as yet obtained from experiments with different manures. A number of illustrations are given showing the effect of different kinds of treatment on the growth of trees.

The results obtained with 86 varieties of strawberries in 1896 are tabulated so as to show the actual and relative productiveness and size of the fruit of plants at the ages of 1 and 2 years. Data as to the flavor of the fruit, habit of the plant, and duration of fruiting period are also given. The average total weight of the crops of all varieties from 2-year-old plants was 68 per cent more than from 1-year-old plants. The average weight of individual berries, however, was 28 per cent greater from the 1-year-old plants than from the 2-year-old ones. The application of water and liquid manures to strawberries after the fruit had set gave no increase in the crop, but retarded its ripening somewhat.

Thinning fruit, S. A. BEACH (*Eastern New York Horticulturist, 1 (1897), No. 2, p. 7*).—This paper, read before the Hudson Valley Horticultural Society, gives the results of experiments in thinning apples in 1896. From a Baldwin tree, heavily loaded with fruit, all wormy, knotty, and otherwise inferior fruit was removed and all clusters thinned to one fruit. A similar tree was left unthinned for comparison. The thinned tree yielded about 14 per cent less marketable fruit than the other tree, but 10 per cent more of its fruit graded No. 1, and it had only one-third as many culls. Three trees each of Baldwin and Greening were thinned as in the first case and in addition enough more fruit was removed to leave the remaining fruit 4 inches apart. Three trees each of the same varieties were left without thinning for comparison. The thinned Baldwins gave about 21 per cent less marketable fruit than the unthinned ones, but 22 per cent more of it graded No. 1. The thinned Greenings gave about 6 per cent more marketable fruit than the unthinned ones and about 10 per cent more of it graded No. 1. A tree of Hubbardston was thinned, as in the other cases, except that the apples were left about 6 inches apart. Another Hubbardston tree was left unthinned for comparison. The thinned tree yielded about 20 per cent less fruit than the unthinned one, but 17 per cent more of it graded No. 1. In all cases the thinned fruit was so much higher colored than the unthinned fruit of the same grades that the increase in its market value, due to thinning, was estimated at 10 to 15 per cent. The thinning and picking took about twice as much time as the picking of the unthinned fruit.

Strawberries, J. CRAIG (*Canada Cent. Exptl. Farms Bul. 27, pp. 5–22, figs. 18, pls. 3*).—The bulletin discusses the culture of strawberries in general and gives notes and tabulated data on a large number of varieties tested at the farm. Two methods of setting strawberry plants were tried. In one case the roots were spread out carefully in all directions in holes deep enough to admit them without doubling them up, and the soil was filled in by hand and pressed firmly. In the other case the roots were inserted somewhat fan-shaped in narrow holes made with a spade and the soil was pressed firmly about them. A perfect stand of plants was obtained in both cases and there was practically no difference in the health and vigor of the plants set by the two methods. The use of a spade reduced the cost of setting considerably and is therefore recommended.

An experiment was made in burning strawberry leaves immediately after picking the fruit as a remedy for leaf rust. Where varieties were planted in double rows one row was burned and the other left. The plants in the burned row at first grew well and were healthy, but the rust soon attacked them. At the end of the season they were still much healthier than the plants in the unburned row. At fruiting time the following year there was scarcely any difference between the two rows. Spraying the plants three times with Bordeaux mixture, once before fruiting and twice afterwards, proved very satisfactory, the sprayed plants being almost entirely free from rust. The author suggests combining the use of Bordeaux mixture with burning the leaves.

Horticulture in the five divisions of the world, C. BALTET (*L'horticulture dans les cinq parties du monde. Paris: Société Nationale d'Horticulture, 1897, pp. 776*).—This book compares the horticultural interests of France with those of 40 other countries. France is given by far the most space, though all the more important countries receive considerable attention. Some of the topics considered are the government's work in advancing horticulture; horticultural education, including lists of horticultural societies, schools, and experiment stations, horticultural books and periodicals, etc.; the horticultural productions, including the extent of the industries, lists of the principal varieties of vegetables, fruits, and ornamental plants grown, and the like.

Forcing house miscellanies, L. H. BAILEY and E. G. LODEMAN (*New York Cornell Sta. Rpt. 1895, pp. 373–414, figs. 10*).—Reprint of Bulletin 96 of the station (E. S. R., 7, p. 400).

The dwarf Lima bean, L. H. BAILEY (*New York Cornell Sta. Rpt. 1895, pp. 139–158, figs. 14*).—Reprint of Bulletin 87 of the station (E. S. R., 7, p. 210).

Storing celery, W. M. EDWARDS and I. L. POWELL (*Amer. Gard., 18 (1897), No. 147, p. 712, fig. 1*).—Two short articles giving directions for the winter storage of celery.

Mushroom culture for amateurs, W. J. MAY (*New York: Charles Scribner's Sons, 1897*).

Wall charts of edible and injurious fungi, J. F. SCHREIBER, text by VON AHLES (*Schreiber's Wandtafeln der essbaren und schadlichen Pilze. Esslingen, 1897*).

Charts of poisonous and suspicious mushrooms, M. RASCHKE (*Tafel giftiger und verdächtiger Pilze. Annaberg: Grasser 'sche Buchhandl, 1897*).

Illustrations of edible and poisonous mushrooms, P. DUMÉE (*Tableau des champignons comestibles et vénéneux. Paris: P. Klencksieck, 1897*).

Biological investigations on some dung-frequenting mushrooms, E. C. HANSEN (*Bot. Ztg., 55 (1897), No. 7, pp. 111–132, pl. 1*).—Notes are given on *Coprinus stercorarius*, *C. rostrupianus*, and *Anixiopsis stercorarius*.

An experiment in tea culture, W. SAUNDERS (*U. S. Dept. Agr., Division of Gardens and Grounds Circ. 1, pp. 10*).—A report on the tea gardens of Charles U. Shepard, Pinehurst, South Carolina.

Winter muskmelons, L. H. BAILEY (*New York Cornell Sta. Rpt. 1895, pp. 351–368, fig. 1*).—Reprint of Bulletin 95 of the station (E. S. R., 7, p. 402).

The recent apple failures of western New York, L. H. BAILEY (*New York Cornell Sta. Rpt. 1895, pp. 53–83, pls. 4, figs. 6*).—Reprint of Bulletin 84 of the station (E. S. R., 6, p. 98).

Cherries, L. H. BAILEY and G. H. POWELL (*New York Cornell Sta. Rpt. 1895, pp. 471–500, figs. 14*).—Reprint of Bulletin 98 of the station (E. S. R., 7, p. 398).

An analytical research on the principal constituents of citrus fruits, V. OLIVERI and F. GUERRIERI (*Atti Staz. chim. agr. Sper. Palermo, Rap. 1893–'95, pp. 3–17*).

Methods of fertilizing citrus fruits, V. OLIVERI (*Atti Staz. chim. agr. Sper. Palermo, Rap. 1893–'95, pp. 24–28*).

Experiments on a fertilizer for citrus fruits, G. MANCUSO-LIMA (*Atti Staz. chim. agr. Sper. Palermo, Rap. 1893–'95, pp. 18–23*).

Results of analyses of the summer and autumn fruit of Ficus indica and of the biennial nodes of the plant, G. MANCUSO-LIMA (*Atti Staz. chim. agr. Sper. Palermo, Rap. 1893–'95, pp. 74–82*).

General observations respecting the care of fruit trees, with some reflections upon weeds, L. H. BAILEY (*New York Cornell Sta. Rpt. 1895, pp. 593–616, figs. 4*).—Reprint of Bulletin 102 of the station (E. S. R., 7, p. 864).

Soil depletion in respect to the care of fruit trees, I. P. ROBERTS (*New York Cornell Sta. Rpt. 1895, pp. 621–637, figs. 2*).—Reprint of Bulletin 103 of the station (E. S. R., 7, p. 956).

Do orchids degenerate? (*Gard. Chron., 3. ser., 22 (1897), No. 562, p. 230*).—A list of a large number of species of orchids growing at Burford, England, is given, together with the dates when the plants were received.

Pruning the prune, S. P. SANDERS (*California State Bd. Hort. Rpt. 1895–'96, pp. 121–124, pls. 2*).

Pruning, grafting, and budding, W. J. ALLEN (*Agr. Gaz. New South Wales, 8 (1897), No. 6, pp. 384–399, figs. 13*).

A new method of grafting, L. DANIEL (*Rev. Gén. Bot., 9 (1897), No. 102, pp. 213–219, figs. 12*).—The method is a combination of flute-grafting and inarching.

Blackberries, L. H. BAILEY (*New York Cornell Sta. Rpt. 1895, pp. 505–526, figs. 14*).—Reprint of Bulletin 99 of the station (E. S. R., 7, p. 501).

Small fruit novelties, H. N. STARNES (*Southern Hort. and Market Gard., 1 (1897), No. 2, pp. 1–4*).—Notes on the behavior of Loganberry, Japan golden Mayberry, strawberry-raspberry, Japan wineberry, tree cranberry, salmonberry, buffalo berry, Japan oleaster, dwarf Juneberry, Crandall currant, and Rocky Mountain cherry at the Georgia Station.

Evaporated raspberries in western New York, L. H. BAILEY (*New York Cornell Sta. Rpt. 1895, pp. 531–564, figs. 27*).—Reprint of Bulletin 100 of the station (E. S. R., 7, p. 865).

An undescribed black-cap raspberry, C. V. PIPER (*Erythea, 5 (1897), No. 10, p. 103*).—*Rubus hesperius* is described as a new species from Washington.

Variety test of strawberries, H. L. HUTT (*Ontario Agr. Col. and Expt. Farm Rpt. 1896, pp. 84–96, figs. 48*).—A table is given comparing the yield, size, and firmness of fruit; vigor of plant; freedom from rust; and date of blooming and ripening of 121 varieties of strawberries. The largest yields were made by pistillate varieties. Other similar tables compare the varieties which ripen early, those which ripen late, and those having large berries. Illustrated notes are given on 47 varieties.

Pruning the vine, M. BLUNNO (*Agr. Gaz. New South Wales, 8 (1897), No. 6, pp. 400–409, figs. 10*).

California walnut industry, B. M. LELONG (*California State Bd. Hort. Rpt. 1895–'96, pp. 77–118, pls. 11, figs. 7*).—The subject is considered under the following heads: Commercial importance; the English walnut; longevity of the walnut; pollination; origin of improved home varieties; varieties of walnut; planting, soil, and other requirements; propagation; budding the walnut; grafting the walnut; the black walnut; pruning the walnut; harvesting; enemies of the walnut; cultural range of the walnut in the United States; and walnut growing in Europe.

The applications of chemistry to horticulture, A. HEBERT and G. TRUFFAUT (*Ann. Agron., 23 (1897), No. 9, pp. 399–429*).—A discussion of the fertilizer requirements of vrieseas, anthuriums, chrysanthemums, cattleyas, azaleas, and cyclamens, based on the composition of the plants and the soils in which they are grown.

The China aster, with remarks on flower beds, L. H. BAILEY (*New York Cornell Sta. Rpt. 1895, pp. 212–233, figs. 10*).—Reprint of Bulletin 90 of the station (E. S. R., 7, p. 215).

Recent chrysanthemums, M. BARKER (*New York Cornell Sta. Rpt. 1895, pp. 239–264, figs. 5*).—Reprint of Bulletin 91 of the station (E. S. R., 7, p. 216).

The flame flowers, Kniphofias, (*Gard. Illus., 19 (1897), No. 964, pp. 371, 372, figs. 4*).—Notes on a number of species, on the method of propagation, etc.

Fritillarias (*Garden, 52 (1897), No. 1349, pp. 242–244, pl. 1, figs. 4*).—Notes on cultivation and species.

The Gloriosas and their culture, J. RUDOLF (*Rev. Hort., 69 (1897), No. 17, pp. 403–406*).

New varieties of carnations (*Gard. Chron., 3. ser., 22 (1897), No. 559, pp. 174–176, figs. 6*).—Notes on M. R. Smith's results in crossing carnations.

The crowfoots (*Garden, 52 (1897), No. 1350, pp. 262–264, pl. 1*).—Notes on a number of species of Ranunculus, grouped as follows: Alpine species, moisture-loving species, border species, and florists' varieties.

New Solanums and their culture (*Wiener illus. Gart. Ztg., 22 (1897), Nos. 8–9, pp. 259–265*).

The vines and Virginian creepers as climbers (*Gard. Illus., 19 (1897), No. 968, pp. 424–426, figs. 5*).—Notes on the ornamental value of a number of grapes and allied vines.

Variety testing and commercial methods, W. MILLER (*Florists' Exchange, 9 (1897), No. 37, p. 860*).—Reasons are given why variety testing will continue to be popular, and yet one of the lower types of experiment-station work and one of the least productive of permanent results.

List of trees and shrubs, H. L. HUTT (*Ontario Agr. Col. and Expt. Farm Rpt. 1896, pp. 97–100*).—A list is given of 230 varieties of trees and shrubs in the collection of the college. The list gives the common name, botanical name, and a note as to the hardiness of each variety.

FORESTRY.

Nomenclature of the arborescent flora of the United States, G. B. SUDWORTH (*U. S. Dept. Agr., Division of Forestry Bul. 14, pp. 419*).—In this bulletin the author gives the nomenclature, together with the synonymy, of the 492 species representing our arborescent flora. This enumeration does not include a large number of recognized hybrids and cultural varieties. In compiling the bulletin the author has followed the Rochester Code of Botanical Nomenclature, and in the appendix are given the Paris Code of 1867, the Rochester Code of 1892, and the Rules of the American Ornithological Union of 1886.

Is protection against forest fires practicable? B. E. FERNOW (*U. S. Dept. Agr., Division of Forestry Circ. 14, pp. 4*).—Statements are quoted from the Report of the Commissioner of Crown Lands of the Province of Ontario, from the Forest Commissioner of Pennsylvania, and from letters from the H. M. Loud and Sons Lumber Company, of Michigan, to show that it is possible, practicable, simple, and cheap to protect large areas from fire. The cost of the protective service and of burning débris is shown to be insignificant in comparison to the loss from fires.

Rate of increase on the cut-over timber lands of Minnesota, S. B. GREEN and H. B. AYRES (*Minnesota Sta. Rpt. 1896, pp. 259–304, figs. 13*).—A reprint of Bulletin 49 of the station (E. S. R., 9, p. 141).

Significance of afforestation in preventing and correcting torrents, F. FRANKHAUSER (*Forester, 3 (1897), No. 11, pp. 126–129*).

Natural reforestation of the mountains of northern Colorado, I, C. S. CRANDALL (*Gard. and Forest, 10 (1897), No. 506, p. 437*).—Notes the gradual reforestation after forest fires.

Natural reforestation of the mountains of northern Colorado, II, C. S. CRANDALL (*Gard. and Forest, 10 (1897), No. 507, pp. 446, 447*).

Mixed plantations, A. C. FORBES (*Gard. Chron., 3. ser., 22 (1897), No. 559, p. 179*).

Private forestry and State forestry, C. A. SCHENCK (*Gard. and Forest, 10 (1897), Nos. 486, pp. 232, 233; 487, pp. 242, 243; 488, p. 252; 489, p. 262*).

The forest reservations in southern California, W. M. TISDALE (*Gard. and Forest, 10 (1897), No. 505, pp. 426, 427*).

History of wood preservation, R. RITTMEYER (*Centbl. gesam. Forstw. Wien, 23 (1897), No. 10, pp. 436–449*).

Notes on cultivated conifers, C. S. SARGENT (*Gard. and Forest, 10 (1897), Nos. 504, pp. 410, 411; 505, pp. 420, 421, fig. 1; 506, pp. 429–431; 507, pp. 440–442*).

Ecological notes on the white pine, E. J. HILL (*Gard. and Forest, 10 (1897), No. 496, pp. 331, 332*).

Sprouting pines, B. E. FERNOW (*Gard. and Forest, 10 (1897), No. 483, p. 209*).—Notes are given on *Pinus echinata*.

Pinus muricata (*Gard. and Forest, 10 (1897), No. 486, p. 232, fig. 1*).

The conifers, with special reference to those which are hardy in Europe, K. VON TUBEUF (*Die Nadelhölzer mit Berücksichtigung der in Europa winterharten Arten. Stuttgart: E. Ulmer, 1897, pp. 164, figs. 100*).

Experimental investigations on the formation of resin deposits in the Abietineæ, P. NOTTBERG (*Ztschr. Pflanzenkrank., 7 (1897), No. 3, pp. 131–143, figs. 3*).

Profits in chestnut culture (*Forest Leaves, 6 (1897), No. 5, p. 89*).

The horse chestnut and its allies, W. J. BEAN (*Gard. Chron., 3. ser., 22 (1897), Nos. 556, p. 130; 558, pp. 155, 157*).

A new hickory, Hicoria pallida, W. W. ASHE (*Gard. and Forest, 10 (1897), No. 493, pp. 304–306, pl. 1*).—Figures and describes a new and apparently local species in the southern Appalachian region.

Quercus lobata in California, C. PURDY (*Gard. and Forest, 10 (1897), No. 483, pp. 202, 203, pl. 1, fig. 1*).

On the effect of the salt content of the air upon the beach pine (Pinus pinaster), L. ANDERLIND (*Forstl. naturw. Ztschr., 6 (1897), No. 6, pp. 247–249*).

The yew trees of Great Britain and Ireland, J. LOVE (*London: Macmillan & Co., 1897, pp. 286, ill.*).

Effect of wind on trees (*Gard. and Forest, 10 (1897), No. 492, pp. 292, 293*).—Extracts are given of a paper by J. B. S. Norton read before the St. Louis Academy of Science on the effect of strong winds on trees.

Electrical attraction of trees, R. G. ABBOTT (*Gard. and Forest, 10 (1897), No. 492, p. 297*).—Notes investigations in France that tend to show the difference in resistance of different kinds of trees.

The rejuvenescence of old trees (*Gard. and Forest, 10 (1897), No. 494, pp. 311, 312, pls. 2, figs. 4.*)—Editorial notes on the rejuvenescence of a large white oak tree in the Arnold arboretum.

Some Utah shade trees, F. C. SEARS (*Gard. and Forest, 10 (1897), No. 498, pp. 356, 357*).—Notes are given of Lombardy poplar, black locust, and box elder.

SEEDS—WEEDS.

The vitality of the common bindweed, J. H. PANTON (*Ontario Agr. Col. and Expt. Farm Rpt. 1896, p. 7*).—Brief notes are given on experiments conducted for the eradication of the common bindweed (*Convolvulus arvensis*). Early in the spring one plat was covered with salt, another with gas lime, and a third sprinkled with a solution of sulphuric acid, while a fourth was hoed as often as leaves appeared. Several applications of gas lime and one of sulphuric acid were made later in the season. An examination of the plats late in October showed that where salt was used the plant was destroyed. With the gas lime the weed was present only on the edge of the plat. The sulphuric acid was found to be without effect, owing to the amount of lime existing in the soil. The plat which had been hoed over almost daily showed a few small plants at the end of the season.

The worst Canadian weeds, J. FLETCHER (*Canada Cent. Expt. Farms Bul. 28, pp. 39, figs. 16*).—This bulletin discusses in a popular way the eradication of weeds by summer fallowing, seeding down, and the use of chemicals. Descriptions and illustrations are given of tower, hare's ear, tumbling, and ball mustards, stinkweed, peppergrass, cow cockle, bladder campion, orange hawkweed, viper's bugloss, hound's tongue, Russian thistle, curl dock, and Indian hay or sweet grass. A list of the more prominent Canadian weeds, with their chief characters, is appended.

Seeds, G. VESTAL (*New Mexico Sta. Bul. 20, pp. 121–146*).—A popular bulletin on seeds, considered under the following heads: General remarks, testing seeds, process of germination, improvement of crops by seed selection, occasional change of seed, harvesting and storing seeds, length of time seeds retain vitality, destroying insects in stored seed or grain, treatment of seeds for prevention of smut, amount of seed required for sowing, etc.

Report upon the best exotic seeds for introduction into temperate Europe, A. WESMAEL (*Rapports Preliminaires 3e Congrès Internat. d'Agr., Bruxelles, 1895, pp. 119–130*).

Beet seed culture, P. DOERSTLING (*Die Rübensamenzucht. Berlin: E. Dreyer, 1897, pp. 46, figs. 7*).—A pamphlet on beet seed culture, giving its history and development and the methods of culture and selection, including the newer methods of propagating seed beets by grafting and from cuttings.

Observations on the vitality and germination of seeds, A. J. EWART (*Trans. Biol. Soc. Liverpool, 10 (1896), pp. 185–193*).

On the longevity of seeds and their preservation in the soil, C. NAUDIN (*Extr. Bul. Soc. Nat. d'Acclim. France, 1897, pp. 3*).

Notes on packing and shipping seed of short vitality, U. DAMMER (*Ztschr. trop. Landw., 1 (1897), No. 2; abs. in Bot. Centbl., 70 (1897), No. 6–7, pp. 196, 197*).—Powdered charcoal is recommended as packing for such seeds as lose their vitality when being shipped to considerable distances.

Germination experiments with peas, wheat, and rye, A. LAGERVALL (*Rpt. Ultuna Agr. Inst. 1895, pp. 49–52*).

Recent experiments in electro-germination, G. DARY (*Electricien, 1897, No. 338*).

On the exosmosis of mucilage by seed, H. COUPIN (*Rev. Gén. Bot., 9 (1897), No. 104, pp. 241–244*).—The author reports upon the loss in weight of various seeds due to the exosmosis of mucilage when placed in water. In some cases the loss was as much as 3 per cent of the total weight for 48 hours' soaking.

Nineteenth annual report of the Swiss seed-control station at Zurich, F. G. STEBLER and E. THIELÉ (*Die schweizerische Samenkontrol Station in Zurich. Neunzehnter Jahresbericht, 1896, pp. 37*).—The report gives the kind of seeds tested and the result.

Report of Swedish seed-control stations during 1895 (*Royal Swedish Agr. Rpt. 1895, pp. 276–330*).—In 1895, 19 stations for seed control were in operation. The total number of samples examined was 7,078. Tables giving average, highest, and lowest results of seed analysis for the samples examined are included in the report, showing purity, germination, weight of 1,000 seeds, water content, character of impurities, etc.

Report of the seed-control station at Gothenburg, Sweden, for 1895–'96, J. E. ALÉN (*Redogörelse för Göteborgs och Bohns läns frökontrollanstalt, 1895–'96. Gothenburg, 1897, pp. 12*).

Report of Danish seed control for 1894–'95, O. ROSTRUP (*Aarsberetning fra Dansk Frökontrol for 1894–'95. Copenhagen, 1896, pp. 38*).—During the year 1,569 samples of seeds were examined. A discussion of the average results obtained and of methods of seed testing are given in the report.

Twenty-fourth report of the Danish seed company "Markfrökontoret" (*Markfrökontorets 24de Aarsberetning. Copenhagen, 1897, pp. 32*).—The report gives discussions of "Ceres" treatment of cereals, root seed, etc., also directions for the culture of mangel-wurzels, horse bean, etc.

Weeds in southern New Jersey, M. TREAT (*Gard. and Forest, 10 (1897), No. 494, pp. 313, 314*).—Notes the presence of hare's-ear mustard (*Conringia orientalis*), *Galinsoga parviflora*, bracted plantain, wild carrot, *Galium mollugo*, and *Hieracium aurantiacum*.

The weeds of New South Wales, J. H. MAIDEN (*Agr. Gaz. New South Wales, 8 (1897), No. 2, pp. 79–81*).

The weeds of Germany, E. ROTH (*Die Unkräuter Deutschlands. Hamburg, 1897, pp. 47; abs. in Bot. Centbl. Beihefte 7 (1897), No. 3, p. 210*).

Noxious weeds, F. T. SHUTT (*Canada Cent. Expt. Farms Rpt. 1896, pp. 275, 276, fig. 1*).—Notes on several of the most troublesome weeds of Canada.

Weed notes, J. H. PANTON (*Ontario Agr. Col. and Expt. Farm Rpt. 1896, pp. 10, 11, figs. 3*).—Brief illustrated notes are given on the habits and methods of eradication of rib grass, perennial sow thistle, and bindweed.

The Bathurst bur (*Jour. Bureau Agr. West Australia, 4 (1897), No. 10, pp. 1251, 1252, fig. 1*).—*Xanthium spinosum* is figured and described, its distribution noted, and means of destroying it pointed out.

On the destruction of wild mustard, H. HITIER (*Jour. Soc. Agr. Brabant-Hainaut, 1897, No. 23*).

Cyperus rotundus, J. WELBORN (*Texas Farm and Ranch, 16 (1897), No. 37, p. 5*).—A popular description of this weed.

On the destruction of weeds (*Prog. Agr. et Vit., 28 (1897), No. 31, pp. 138, 139*).

On the destruction of Juncus and Carex in meadows, J. GRAFTIAU (*Ing. Agr. Gembloux, 1897, No. 9*).

DISEASES OF PLANTS.

Apple rust, F. D. CHESTER (*Delaware Sta. Rpt. 1896, pp. 63–69, figs. 5*).—Notes are given on various species of Gymnosporangium and the relation between the different stages of this fungus as produced on cedar and apple trees is pointed out. The species of apple rust occurring in the United States are enumerated. Of these species *Gymnosporangium macropus*, *G. globosum*, and *G. clavipes* are the most injurious to the cultivated apple, having for their teleutospore host the red cedar. The destruction of such trees in the immediate vicinity of apple orchards is recommended. Notes are given which seem to indicate a marked variation in susceptibility of the different varieties of apples to the rust, and a tabulation is presented of the varieties of apple trees occurring in 3 different orchards with the relative amount of rust infection on each variety.

Pea blight, J. H. PANTON (*Ontario Agr. Col. and Expt. Farm Rpt. 1896, pp. 13–15*).—Notes are given of a diseased condition of pea vines in which the affected plant fades and appears prematurely ripe while the peas are scarcely formed in the pod. Such vines appeared in patches over the field, but soon spread, covering large areas. On close examination, the plants are seen to be decayed at the surface of the ground and in some cases mycelial films were present. Examinations for *Peronospora viciæ* and *Erysiphe martii* failed to show either of these fungi present, nor were any insect attacks noticed. The author is inclined to believe that the blight in question is a diseased condition of the plant due to adverse physical conditions of the soil, extreme drought, and the continual planting of the peas on the same ground year after year.

The spotting of peaches, F. D. CHESTER (*Delaware Sta. Rpt. 1896, pp. 60–63, figs. 4*).—This disease, which is due to *Cladosporium carpophilum*, is one of the most common in the State. It is characterized by the appearance of small black spots $\frac{1}{16}$ to $\frac{1}{8}$ in. in diameter, more or less congregated or united. When the spots coalesce over a considerable portion of the fruit, uniform black blotches occur where the skin becomes tough, dry, and leathery. The disease affects the fruit by reducing the market value, on account of rendering it unsightly in appearance, and by causing the fruit to crack, offering easy entrance to other organisms which produce rapid decay. It also greatly reduces the size of the infected fruit. Notes are given on the life history of the fungus and on successful inoculation experiments on plums made with spores taken from pure cultures. When the spores were placed upon the uninjured surface of immature plums, they were without effect on the plant although the fruit was kept moist under a bell jar to aid in the infection. When sown on the uninjured surface of green peaches, a slight growth resulted, and when the inoculation of the peach was effected by punctures, the fungus produced spots quite abundantly. It is stated that the disease may be held in check by early and repeated applications of Bordeaux mixture.

Formalin for prevention of potato scab, J. C. ARTHUR (*Indiana Sta. Bul. 65, pp. 19–36, pls. 2*).—Preliminary tests of formalin, made in a greenhouse by soaking potatoes for 2 hours in solutions of the strengths of 1:800, 1:400, 1:200, 1:120, and 1:40 resulted in no injurious effect upon the germination of the tubers and indicated that formalin is a successful fungicide for scab.

Three field tests were made with formalin solutions of various strengths. In two cases the tubers planted were badly scabbed and in a third case they were apparently free from scab. In one case formalin was compared with corrosive sublimate treatment. The tubers in one test were treated 1 hour and in the others 2 hours. In all cases the potatoes were grown in soil which had been cropped with potatoes continuously for the 7 preceding years and contained scab germs. The soil was light, shallow, and well drained. No fertilizers were used. The rainfall in July was much above the normal. A summary of the results of the 3 tests is shown in the following table:

Percentage of injury to crop from scab; seed tubers treated with corrosive sublimate and formalin and untreated.

Condition of seed tubers.	Not treated.	Treated.					
		Duration.	With formalin 1:1,200.	With formalin 1:800.	With formalin 1:400.	With formalin 1:200.	With corrosive sublimate 1:1,000.
	Per ct.	*Hours.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Scabbed	10.09	1	10.60	10.54	7.16	5.65	.....
Do	8.98	2	8.42	6.49	7.34	3.72	4.33
Free from scab	4.24	2	.....	.....	3.12	.....	.....

Formalin treatment for potato scab under farm conditions was tried by farmers in 4 localities. All reported favorable results. The injury from scab at the station was much greater in the portions of the field containing most soil moisture. Tables are given showing in detail the results of the tests at the station. Experiments showing that formalin is not dangerously poisonous are noted. The author's method of estimating the injury from scab is prescribed. A bibliography of literature on the germicidal, therapeutic, and physiological action of formalin is given. The author believes that formalin is equal to corrosive sublimate as a treatment for potato scab, and recommends a solution of the approximate strength of 1:300. The directions given are to soak tubers 2 hours in a solution of ½ pt. formalin in 15 gal. of water.

Damping off, G. F. ATKINSON (*New York Cornell Sta. Rpt. 1895, pp. 313–346, pls. 6, fig. 1*).—Reprint of Bulletin 94 of the station (E. S. R., 7, p. 220).

Some fungus diseases of celery, B. D. HALSTED (*Amer. Gard., 18 (1897), No. 149, p. 743*).—Notes are given of celery blight (*Cercospora apii*), leaf spot (*Phyllosticta apii*), leaf blight (*Septoria petroselini*), celery rust (*Puccinia bullata*), and a bacterial disease. Most of the material was drawn from Bulletin Q of the New Jersey Stations (E. S. R., 3, p. 884).

Gooseberry blight (*Jour. Bd. Agr. [London], 4, No. 2, pp. 202–204, fig. 1*).—Brief notes are given on *Microsphæria grossularia*. Sulphur, sulphid of potassium, and Bordeaux mixture are all recommended as preventive means for its control.

Plum fruit rot, B. D. HALSTED (*Gard. and Forest, 10 (1897), No. 506, pp. 436, 437*).—Notes are given on an unusually severe attack of *Monilia fructigena* on plums, together with suggestions for preventive treatment.

On the cause of a leaf curl of potatoes, E. ROZE (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 1, pp. 59–61*).—A disease called frisolée due to *Pseudocommis vitis* is described. It is said to resemble the ordinary potato rot due to *Phytophthora infestans*.

Tomato disease on forced plants, J. C. ARTHUR (*Amer. Florist, 13 (1897), No. 491, pp. 282, 283*).—General directions are given for the prevention of disease on tomatoes grown under glass.

The diseases of sugar cane, II, C. A. BARBER (*Science Progress, n. ser., 1 (1897), No. 4, pp. 461–482*).

A lily bulb disease, G. MASSEE (*Gard. and Forest, 10 (1897), No. 504, pp. 414, 415*).

A snowdrop disease, G. MASSEE (*Kew Misc. Bul. 124, p. 172*).—A brief note is given of a disease of snowdrops due to *Sclerotinia galanthi*. Bordeaux mixture is said to prevent attacks of the disease.

A canna disease (*Kew Misc. Bul. 124, p. 173*).—A disease of cannas due to *Uredo cannæ* is mentioned as occurring in Brazil and Trinidad and may possibly reach Europe.

A fungus disease of Porthesia chrysorrhœa, G. LINDAU (*Notizbl. k. bot. garten u. Museum, Berlin, 1897, No. 9, pp. 288, 289*).

Fungus diseases of the chrysanthemum, B. D. HALSTED (*Amer. Gard., 18 (1897), No. 147, pp. 709, 710, figs. 4*).

Wakker's hyacinth bacterium, E. F. SMITH (*Bot. Gaz., 24 (1897), No. 3, p. 188*).—Abstract of paper read before Section G of the American Association for the Advancement of Science at the Detroit meeting, August, 1897. The specific cause of the disease is said to be *Bacterium hyacynthi* and not *Bacillus hyacinthi septici* as claimed by Heinz.

Bacteria in their relation to gardeners, R. ADERHOLD (*Ueber die Bakterien in ihren Beziehungen zur Gäartnerei. Breslau, 1897, pp. 15*).

Concerning diseases of Galanthus and Pæonia, C. A. J. A. OUDEMANS (*Konikl. Akad. Wetensch. Amsterdam, 1897, p. 455; abs. in Hedwigia, 34 (1897), No. 5, Repert., p. 138*).—The diseases are caused by *Botrytis galanthi* and *B. pæoniæ*, n. sp.

Œdema in the roots of Salix nigra, H. VON SCHRENK (*Bot. Gaz., 24 (1897), No. 1, pp. 52–54, figs. 2*).

Rusty appearance of elm leaves, O. S. WHITMORE and B. D. HALSTED (*Gard. and Forest., 10 (1897), No. 504, pp. 417, 418*).—Notes are given of a rusty appearance of elm leaves the cause of which is not known.

Pseudocommis vitis parasitic on marine plants, E. ROZE (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 9, pp. 410, 411*).—Notes the occurrence of this myxomycete in various aquatic plants.

On the insolubility of copper in soap mixtures, L. DEGRULLY (*Prog. Agr. et Vit., 28 (1897), No. 30, pp. 90, 91*).

Experiments in the treatment of apple scab, F. D. CHESTER (*Delaware Sta. Rpt 1896, pp. 51–59, fig. 1, dgm. 1*).—This is a reprint from Bulletin 29 of the station (E. S. R., 7, p. 785).

The spraying of orchards: Apples, quinces, and plums, E. G. LODEMAN (*New

York Cornell Sta. Rpt. 1895, pp. 105–134, figs. 8).—Reprint of Bulletin 86 of the station (E. S. R., 7, p. 137).

Experiments in the treatment of peach blight and rot, F. D. CHESTER (*Delaware Sta. Rpt. 1896, pp. 35–51, dgms. 4*).—This is a reprint from Bulletin 29 of the station (E. S. R., 7, p. 785).

Treating celery for leaf blight, P. H. DORSETT (*Amer. Gard., 18 (1897), No. 148, p. 725, fig. 1*).—Reports the use of Bordeaux mixture and ammoniacal copper carbonate for the prevention of leaf blight. The Bordeaux mixture proved the better fungicide.

Bordeaux mixture for the treatment of potato disease, W. B. PLOWRIGHT (*Gard. Chron., 3. ser., 22 (1897), No. 564, p. 267*).—The serious loss to the potato crop of Ireland is said to be due to potato rot and in the future the extended use of Bordeaux mixture is advised to prevent similar losses.

Sulphur and lime as a fungicide, W. TRIGALET (*Amer. Florist, 13 (1897), No. 492, p. 306*).—A mixture of these two substances is recommended for diseases of the rose, carnation, violet, and chrysanthemum. Directions for preparation and application are given.

Autumn treatment for black rot, J. DEVILLE (*Prog. Agr. et Vit., 28 (1897), No. 36, p. 271*).

Treatment of black rot, G. COUDERC (*Prog. Agr. et Vit., 28 (1897), No. 38, pp. 323–336*).

On the prevention of black rot, E. FERRIÈRE (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 7, p. 383*).—The author recommends the addition of molasses to the ordinary copper solutions for preventing attacks of black rot.

A new fungicide for the prevention of black rot, G. LAVERGNE (*Prog. Agr. et Vit., 28 (1897), No. 28, pp. 38, 39*).—Copper sulphate 500 gm., black or green soap 1 kg., water 100 liters.

On the use of acetate of copper in combating the grape Peronospora, G. BRIOSI (*Inst. bot. Univ. Pavia, 1897, pp. 13*).

Autumn treatment for chlorosis of grapevines, L. DEGRULLY (*Prog. Agr. et Vit., 28 (1897), No. 41, pp. 405–408*).

Spray calendar, E. G. LODEMAN (*New York Cornell Sta. Rpt. 1895, pp. 86–92*).—A spray calendar for fruits and vegetables, arranged alphabetically, with formulas for the preparation of Bordeaux mixture, ammoniacal copper carbonate solution, copper sulphate solution, Paris green, London purple, hellebore, and kerosene emulsion.

ENTOMOLOGY.

Report of committee on economic botany and entomology, J. H. PANTON (*Ontario Agr. Col. and Expt. Farm Rpt. 1896, pp. 236–239, fig. 1*).—It is stated that in answer to circulars of inquiry sent out, the potato beetle (*Doryphora decemlineata*), red legged grasshopper (*Melanoplus femur-rubrum*), horn fly (*Hæmatobia serrata*), cutworm (*Hadena mamestra*), tent caterpillar (*Clisiocampa americana*), and the army worm (*Leucania unipuncta*) were the most serious among 43 species of insect pests referred to; and that the army worm (*Leucania unipuncta*), oat aphis (*Siphonophora avenæ*), blister beetle (*Epicauta pennsylvanica*), Hessian fly (*Cecidomyia destructor*), peavine caterpillar (*Mamestra trifolii*), squash bug (*Anasa tristis*), and cankerworm (*Paleacrita vernata*) are likely to become injurious; that more than half of the replies indicated the presence of the buffalo carpet beetle, and finally, that 35 out of 57 replies noted that spraying is practiced and is followed by good results.

Report of the apiculturist, R. F. HOLTERMANN (*Ontario Agr. Col. and Expt. Farm Rpt. 1896, pp. 221–228, figs. 4*).—A record is given of experiments with foul brood, wintering (both inside and out), the production of comb honey, moving for fall pasture, and feeding bees.

In the foul-brood experiments an endeavor was made to determine whether disease may be transmitted through the wax. Good samples of wax were thoroughly infected with the germs of foul brood. The wax was then broken into small pieces to facilitate melting, and before all the pieces had melted it was formed into sheets and milled. The foundation thus made was placed in frames and a swarm put upon it. Nearly 2 months later an examination was made for foul brood, but no trace of the disease was found.

The wintering experiments were a repetition of those made in 1895. A portion of the number of colonies employed were packed with 672 thicknesses of manila paper, 10 thicknesses of newspaper, a quilt, and plain shavings, in addition to side packing. The remainder of the colonies were simply packed above with a quilt and plain shavings. The object was to determine the difference between absorbents and upward ventilation and in the prevention of the escape of heat and moisture by other means than the entrance, which was 5 in. wide. To facilitate the movement of the bees from one comb to another a hole was cut in the center of the combs. In previous experiments this was not done. As a result, it was found that hives packed with paper had a very slight advantage over those not so packed, and that the hives in which holes had been made in the comb to facilitate the movements of the bees wintered better than those not so treated.

In the experiments in the production of comb honey, an endeavor was made to learn how straight comb, unstained by travel, may be produced. Supers, with bee spaces over the sections, were employed between the last sections and the wood sides of the supers. Besides the usual 1 bee space, 2 or more bee spaces were made in some instances. These were secured by the use of either perforated or slatted dividers. As a result, it was found that pop holes were less numerous where the space was left over the sections, and that where 2 bee spaces were employed the results were the best. Of the dividers employed, the perforated variety gave the best results. Where the slatted divider was used the comb was given a ribbed appearance, much like the common washboard. In explaining the difference found between the use of 1 and 2 bee spaces, the author suggests that the 2 bee spaces permit of an extra layer of bees on the outside, which keeps up day and night the normal heat necessary to comb building and capping.

The experiments in outside wintering extended over a period of several years. It was found that when the brood chamber is divided into 2 parts and the upper portion of the frames separated from the lower by a bee space which allows the cluster, which is globular in form, to contract and expand with the changes in outside temperature, the best results are obtained.

In the fall of 1895, 16 colonies were moved 9 miles to a buckwheat pasture and compared with colonies kept at home. In the case of the 16 hives which were moved there was a gain of 706 lbs. in 47 days. In 1896, 36 colonies of varying strength were moved, and showed a gain of 1,251 lbs. As a result of the experiments, it appears that moving bees where practicable pays, and that the strongest colonies will yield better returns, while the weaker colonies will be strengthened.

In the feeding experiments, a sirup was made in the proportion of 2 lbs. granulated sugar to 1 lb. of water. In some cases sugar was dissolved in boiling and in other cases in cold water. Neither method of dissolving was found to have an advantage over the other. In regard to the effect of feeding, it was found that there is a great difference between the weight of the stores supplied and the increase in weight of the hive, there being a loss of from 31 to 56 per cent. This is accounted for by evaporation and by an increased consumption of the stores by the bees in consequence of excitement during storing.

The conclusions to be drawn from the experiments are, that it will not pay to extract honey and replace it by sugar sirup for winter with the expectation of making a profit; but, if feeding is resorted to, strong colonies can be fed with the smallest percentage of loss.

Bees and fruits: Codling-moth eggs not laid in the bloom, E. S. LOVESY (*Amer. Bee Jour., 37* (*1897*), *No. 14, pp. 211, 212*).—The author complains that spraying for the codling moth when the trees are in bloom results in the death of the bees that visit them. A case in New York State is cited where 200 colonies were thus destroyed.

Experiments in a greenhouse demonstrated that if the temperature is kept at 50° F. from the time the moths emerge from the cocoons they will lay their eggs, the larvæ will hatch and bore into the mature apples and finally eat their way out, and in about 6 weeks appear as adult moths. If the temperature be kept at 70° the period will be shortened by about a week, while if the temperature be dropped below 60° the moths will not emerge from the cocoons. From this it is concluded that, especially in Utah, spraying should not be done when the trees are in bloom but later, for the trees will and do bloom at a temperature lower than 60°, and they are usually in bloom before the moth hatches. In parts of Wasatch and other counties no codling moths can live even if imported, since the temperature is too low. The experiment and the facts stated show that the moth does not necessarily lay in the blossom, and that in Utah it is the fruit that should be sprayed.

The brown tail moth, C. H. FERNALD and A. H. KIRKLAND (*Massachusetts Hatch Sta. Special Bul. July, 1897, pp. 15, figs. 1, pls. 3*).—The discovery of this new insect pest in Massachusetts and in the United States is briefly related, its synonym discussed, and the adult, larval, and pupal stages described. It was first brought to notice May 8, 1897, by a report that the gypsy moth was doing great damage at a place in Somerville, Massachusetts. Specimens sent to the station were identified as the well-known brown tail moth of Europe.

Relative to its importation the authors state that upon inquiry of the residents in the infested area, embracing the greater part of Somerville, a large part of Cambridge and Everett, and a small part of Medford, revealed the fact that the insect had been there for 5 years.

The food plants of the larvæ as determined for America are as follows: Basswood (*Tilia americana*), geranium (*Geranium sanguineum*), grape (*Vitis cordifolia*), Virginia creeper (*Ampelopsis quinquefolia*), sugar maple (*Acer saccharinum*), white maple (*A. dasycarpum*), sycamore maple (*A. pseudo-platanus*), red clover (*Trifolium pratense*), wistaria (*Wistaria consequana*), prune (*Prunus domestica*), cherry (*P. avium*), wild black cherry (*P. serotina*), peach (*P. vulgarius*), *Spiræa thunbergii*, raspberry (*Rubus strigosus*), blackberry (*R. villosus*), strawberry (*Fragaria virgiana*), rose (*Rosa nitida*), crab apple (*Pyrus coronaria*), *Pyrus pinnatifida*, pear (*Pyrus communis*), apple (*P. malus*), quince (*Cydonia vulgarius*), Japanese quince (*C. japonica*), currant (*Ribes rubrum*), gooseberry (*R. grossularia*), *Weigela rosea*, burdock (*Arctium lappa*), white ash (*Fraxinus americana*), plantain (*Plantago major*), swamp dock, (*Rumex verticillatus*), curled dock (*R. crispus*), rhubarb (*Rheum rhaponticum*), American elm (*Ulmus americana*), black walnut (*Juglans nigra*), weeping willow (*Salix babylonica*).

The majority of these were attacked by the caterpillars in moving from pear orchards. During the latter half of May the caterpillars were in great numbers and swarmed from defoliated pear trees and crawled along the ground, walks, and fences in search of food. Trees in full foliage in the path of this migrating army were stripped in a few days. At one place the caterpillars were noticed on May 22, migrating toward and ascending a large cherry tree which at that time was covered with dense foliage. Five days later scarcely a green leaf remained on the tree, and even the half-grown cherries were partly devoured. In a badly infested orchard the noise made by thousands of these caterpillars feeding in the evening could be plainly heard. Swarming from such places, the caterpillars crawled up the trees along the streets and spread over the walls of the houses. Numerous complaints were made of the entrance of these insects into the houses, and the sweeping and washing down of the masses of caterpillars from the piazzas and walls of houses along Park street was a daily occurrence.

"One of the most annoying features of this caterpillar invasion was the painful irritation or nettling caused by the insect when coming in contact with the skin. The hairs of the caterpillar are brittle and easily become detached, and when they come in contact with the skin, produce a most intense irritation. From this cause many persons have suffered so severely as to require the aid of a physician. The invasion of houses by these insects was a common occurrence, and not infrequently they made their way into the sleeping apartments."

The habit of the larvæ of eating the entire leaf except the midrib, their gregarious inclinations, the manner of making the web, etc., are noted and the subject of natural enemies and remedies discussed. The

English sparrow and the Baltimore oriole have been observed attacking the larvæ, but neither seem to prefer them to other caterpillars. No parasitic insects are noted. Removal of the egg masses, treatment with kerosense emulsion, Paris green, and arsenate of lead are recommended.

Relative to laws, the example of France enacting them as early as 1734 against this particular insect is mentioned. The text of the act of the Massachusetts Legislature directed against the insect at its last session is given in full.

The fruit maggot fly, W. W. FROGGATT (*Agr. Gaz. New South Wales, 8 (1897), No. 6, pp. 410–414, figs. 8*).—Under the name *Tephritis tyroni* the author describes what is believed to be a new species. It is a different insect from the fruit fly, *Halterophora capitata*, reported from Western Australia, the Azores, Bermudas,[1] and Malta,[2] and described originally by Wiedman in 1886 as *Tephritis capitata.* It is larger and of a lighter color as well as different in markings. The pest promises to become one of the most serious with which fruit growers in New South Wales have to deal.

The eggs of the insect are deposited beneath the skin of the fruit about the time it is beginning to color. The larva gnaws irregular passages toward the centre and, in the case of apples, quinces, and other core fruits, soon reduces the portion surrounding the core to a rotten mass. In oranges the first evidence of disease appears in dark spots where the fly's ovipositor has pierced the skin. The quarter-grown maggots are semitransparent, anteriorly slender, thickening posteriorly, sharply rounded terminally, have two curious black oral hooks, and a pair of cephalic spiracles which are tinged with yellow. They live in the fruit until it is perfectly putrid. The full grown dull yellow larvæ (about ½ in. in length) emerge and pupate just below the surface of the ground. The female fly is somewhat larger than the male and is provided with a needle-like ovipositor. The head is broad, the eyes large and brown, the antennæ yellow with the third joint long. The thorax is stout and of a dull yellowish brown with a bright yellow lateral patch and a dorsal one over the scutellum. The abdomen is dark reddish-brown with a distinct dorsal transverse yellow point in its anterior half.

The insect has been well known in Queensland since 1878, when specimens attacking oranges were sent to the Royal Gardens at Kew. In 1888 it was found attacking all kinds of fruit in the Toowomba by H. Tryon. As yet the southern part of this colony and Victoria is free from the pest, but it is thought unless stringent Governmental measures are taken it will spread everywhere.

In a note by Dr. Cobb on the fly or so-called "Queensland fruit fly" accompanying this paper, it is pointed out that spraying is use-

[1] Insect Life, 3 (1890), pp. 5–8. It is here described under the name of *Ceratitis capitata* Wiedm.

[2] Gard. Chron. (1890), p. 655.

less; that the best remedial measures are destroying the infested fruit. stirring up the ground beneath the trees or drenching it with kerosene to kill the larvæ and pupæ, covering the trees just before fruit ripening with fine netting, decoying the flies from fruit trees by exposing small quantities of fruit, and Governmental repressive measures.

Report of the entomologist, M. H. BECKWITH (*Delaware Sta. Rpt. 1896, pp. 112–131*).—The author speaks very briefly of the injuries done during the year by the fruit bark beetle (*Scolytus rugulosus*), catalpa sphinx moth (*Sphinx catalpa*), imported currant worm (*Nematus ventricosus*), chestnut weevil (*Balaninus carytrypes*), cockroaches (*Periplaneta pennsylvanica* and *Blatta germanica*), imbricated snout beetle (*Epicærus imbricatus*), and the San José scale. An application of arsenate of soda at the rate of 1 oz. to 5 gal. of water was made as a remedy against the larvæ of the catalpa sphinx moth, but it was found to injure the foliage as well as the worms. A solution of one-half the strength employed, it is thought, would have accomplished the object without injuring the foliage. A preparation known as Insectoline was employed successfully against cockroaches.

A considerable portion of the author's time during the year was taken up with the study of the San José scale. Some 115 orchards, including a number of nurseries, were visited, and an endeavor made to trace the history of the scale in the State. As a result it was found that the scale was first introduced into the State at 2 widely separated places on crab apple and plum trees purchased from the Pomona nurseries in 1891; and that since that time infested trees have continued to be brought in from this and the Lovett nurseries, so that now there are 13 different infected localities in the State.

The remedies used at the various places found to be infected were kerosene emulsion, the application of sludgite with a brush, whale-oil soap, the winter resin wash, and in one case burning the infected trees. The successful remedies are said to be (1) the application of a hot mixture of whale-oil soap and water, in which there was not less than $2\frac{1}{2}$ lbs. of soap to each gallon of water; (2) the winter resin wash, composed of 120 lbs. of resin, 30 lbs. of caustic soda, 15 lbs. of fish oil, and sufficient water to make 100 gals.; and (3) hydrocyanic-acid gas.

The remainder of the report is devoted to the status of the San José scale in the United States, in which the author goes briefly over the history of the insect; hydrocyanic-acid gas for destroying the San José scale; and notes on the treatment of the San José scale, concluding with the statement that it is of very little use to attempt to treat scale-infested trees when covered with foliage, but that as soon as the foliage has fallen a thorough treatment with a hot solution of whale-oil soap and water is advisable.

Life history of Sesia stelidiformis, F. TOMOLA (*Verhandl. k. k. zool. bot. Gesell. Wien, 47 (1897), No. 6, pp. 420–422*).—From the author's studies at Buda Pesth it appears that *Euphorbia epithymoides* forms the food plant of the larvæ of this insect. They occur on it, however, only in sunny places. Larvæ taken in April produced the mature moth from about May 20 to the middle of June. On May 29 a pair were found copulating and so remained until the next day. On that and the following days the female laid its eggs rather high up on the stalk of the food plant, both isolated and in small groups, of which the largest numbered 20 eggs. Some four days after copulation the male died. The egg is of a flattened oval shape and measures in its chief dimensions 0.35 by 0.3 mm. On its flattened side it has a small impression. The upper end has a small furrow and the opposite end is rounded. Under the lens its surface appears covered with deep impressions, the edges of which have a golden glitter in the sunshine. It is described as a whole as having a somewhat biscuit form. The yellow larvæ gnaw their way out through the upper end of the egg and crawl down along the stalk of the plant to find a place near the root crown in which to bore. A favorable spot is not, however, always found, and it appears probable that, like *S. impiformis*, they will occasionally enter the stalk some distance above the ground. By June 14 the larvæ, in the author's experiment, had all disappeared. Among the moths collected intermediate forms were common: *S. stelidiformis* and *S. s. icteropus*, ♂.

A new tobacco pest, G. McCarthy (*North Carolina Sta. Bul. 141, pp. 2, figs. 2*).—The moth, *Gelechia picipelis*, which is found native in North Carolina feeding upon the perennial solonaceous weed, *Solanum carolinense*, has been found doing considerable damage to tobacco. Although the insect probably inhabited its present range of nearly the entire tobacco-growing area of the United States from the time of the discovery of America, it was first noted as attacking tobacco in 1896. Thus far the damage noted is serious only in three townships of one county in North Carolina and in a district in Florida. A popular description of the insect is given and of its life history and mode of attack, which is that of a leaf miner. The only applicable remedy at present seems to be clean cultivation, with frequent stirring of the soil close to the plants to destroy the dormant pupæ. By closely watching the leaves the caterpillars may be destroyed with the fingers as soon as the leaf blotches caused by them appear.

An invasion of Cochylis and of Œnophtira and the means of defense, L. Degrully (*Prog. Agr. et Vit., 14 (1897), No. 26, pp. 759–761*).—Large numbers of *Cochylis roserana* are noted as having invaded the vineyards of Maine-et-Loire, Gironde, Lot-et-Garonne, Haute-Garonne, Aude, Basses-Pyrénées, Gard, Var, Rhône, Sâone-et-Loire, etc. The damages are said to have been very considerable. The use of pyrethrum mixtures is being discarded on account of the expense of the pyrethrum powder, essence of terebenthin being substituted for it according to the following formula: Water, 100 liters; black soap, 3 kg.; essence of terebenthin, 2 liters. In making up this mixture the soap is first dissolved in the water and then the terebenthin added, the mixture being agitated the while. The amount of terebenthin used is an important matter. If less than 2 per cent be used, it will be ineffective; if too much is used it will injure the grapes. Numerous complaints against the "pyrale" (*Œnophtira pilleriana*) are also noted. The best method of destroying both these insects is thought to be by means of hot water.

The destruction of the "Saúva," F. W. DAFERT and L. RIVINUS (*Relat. Inst. Agron. São. Paulo [Brazil], 7–8 (1896), pp. 221–267, figs. 12, tables 2*).—The means of destroying the ant *Atta sextens*, which is a very serious pest in Brazil, are somewhat exhaustively considered. Its habits and its intelligence render it a difficult insect to combat. Its mines extend to considerable depths and over an area as much as 100 meters broad, while the individuals number into the millions. The various methods of combating the insect are brought together and classified as (1) those in which poisonous gases, sulphurous fumes, etc., are used; (2) destroying by the explosion of gases (bisulphid of carbon or benzine vapor); (3) burning out with illuminating gases; (4) smoking out; and (5) mechanical measures. Various pieces of apparatus to be used in the work are figured. The most noteworthy facts regarding the insect are:

(1) The ants' resistance to destruction by poisons is remarkable. They will withstand a 2½-hour exposure in vacuum and will live for a day while under pressure.

(2) They are readily destroyed by explosions, if in contact with the exploding medium. They can not withstand a temperature above 50° C.

(3) The most practical means of destroying them is by burning out the nests by using carbon bisulphid which, after it has saturated the nest, is to be exploded; by the use of burning sulphur and vapors of arsenic.

(4) The nests must be attacked on all sides.

The destruction of small insectivorous birds should be avoided. The tables given bring out the changes that colonies studied underwent as well as the applicability of the various destructive measures.

The destruction of insects injurious to the vine, P. COSTE-FLORET (*Prog. Agr. et Vit., 28 (1897), Nos. 29, pp. 64–72; 30, pp. 94–102; 32, pp. 151–161; 33, pp. 178–181, figs. 22*).—This essay treats the subject according to the 4 seasons of the year. Some of the well-known remedies are noted. The common French remedy (hot water) against the larvæ of the "pyrale" (*Œnophtira pilleriana*) is discussed at some length, and a heating apparatus mounted on wheels is figured. The expense of this remedy is computed at 53.5 francs per hectare (about \$4.12 per acre). With this is compared the sulphur-fume method or "clochage" which costs from 33.3 francs to 40.8 francs per hectare (about \$2.56 to \$3.14 per acre), according as slow matches or ordinary sulphur is used. Where slow matches are used, 36 kg. per acre are necessary, as contrasted with 44 kg. when ordinary sulphur is used. Other methods noted are the use of acid sprays, carbon bisulphid, an emulsion of carbon bisulphid, lime water, and carbonate of soda; pyrethrum-soap solutions, a mixture of 15 per cent pyrethrum and 85 per cent sulphosteatite, and another of 50 kg. of quicklime, 50 of sulphur, and 3 of pyrethrum used as a powder. The insects specially noted are the "pyrale" (*Œnophtira pilleriana*), "lethre" (*Anomala vitis*), "attelabe" (*Rhinchites conicus*), "hanneton" (*Melolontha vulgaris*), the "cousi-cousi" or "Porte-selle de Béziers" (*Ephippigera bitteriensis*), the "cochylis" (*E. roserana*), "erinose" (*Phytoptus vitis*), "escargot" (*Helix pomatia*), "altise de la vigne" (*Altica oleracea*), and the "ecrivain" (*Eumolpus vitis*).

Calcium carbid as a phylloxeracide, E. CHUARD (*Chron. Agr. Canton Vaud, 10 (1897), No. 10, pp. 275-279*).—It is here noted that the gas evolved by this substance upon the application of water or in the presence of moisture has been used in several places as an insecticide, notably against the white grubs. Experiments are noted in which 50 gm. of the carbid was placed in pots containing worms and somewhat successful results obtained. In such pots the plants were vigorous and green, while in control experiments they had a miserable appearance. It is also noted that Dupertius employed the substance against the phylloxera; that the author buried 100 gm. near the base of the vines in the vineyard with good results. In Dupertius's experiment 102 plants were treated, but inasmuch as on 34 stocks no phylloxera were found, the results are not of the highest value. The author notes that the gas emitted by the carbid is impure; that 100 parts of the carbid give besides acetylene from 0.24 to 0.4 parts of ammonia; from 0.7 to 0.9 parts sulphureted hydrogen; and from 0.018 to 0.032 phosphureted hydrogen. To these is due the odor and the toxic qualities of the acetylene.

Notes on the properties and the employment as an insecticide of calcium phospho-carbid, E. CHUARD (*Chron. Agr. Canton Vaud, 10 (1897), No. 16, pp. 427-436*).—This compound, we are told, is made like the ordinary calcium carbid, but with the addition of calcium phosphate. In appearance it is similar to the ordinary carbid, compact, hard, of a dark-gray color, deliquesces rapidly, leaving a light-gray or yellowish-white powder. The essential difference between calcium carbid and the new compound lies in the nature of the gas liberated. While the former in the air emits but a faint aliaceous odor of impure acetylene, the phospho-carbid emits a strong, disagreeable odor of phosphureted hydrogen. If water is added to it in sufficient amount, gas is given off so rapidly that it spontaneously ignites, but this does not happen when the compound decomposes slowly. Hence in the dry or humid temperature of ordinary weather it may be managed without danger. Experiments with the carbid are noted and shown to be somewhat unsatisfactory. But with the phospho-carbid there is a larger amount of gas given off with the acetylene, and when placed in the ground by the side of the vine it is given off with sufficient slowness to act as an insecticide before it is oxidized by the soil. The amount of phosphureted hydrogen discharged varies from 11 to 98 per cent. In the latter case it is in the presence of a large amount of water and ignites spontaneously. As an insecticide the gas is thought better than bisulphid of carbon. Experiments are noted in which phosphid of calcium was employed alone, and the conclusion is drawn that this is not sufficiently effective and is moreover too costly. Further, it is noted that phospho-carbid has been used in various amounts and shown to be effective when used at the rate of 100 gm. to a plant, and further, that 200 gm. to a plant does not injure the latter.

Report of the professor of biology and geology, J. H. PANTON (*Ontario. Agr. Col. and Expt. Farm Rpt. 1896, pp. 5–20, figs. 5*).—The character of the work in the laboratory is described, as well as the general and practical work of the author. Bordeaux mixture was tried as an insecticide with good results. A list of insects identified is given, and the pear tree slug (*Eriocampa cerasi*), nematodes, spring cankerworm (*Paleacrita vernata*), red legged grasshopper (*Melanoplus femur-rubrum*), tussock moth (*Orgyia leucostigma*), and the remedies against them noted.

The morphology and classification of the Pauropoda, with notes on the morphology of Diplopoda, F. C. KENYON (*Tufts College Studies, 5 (1895), No. 4, pp. 77–146, pls. 4, figs. 2; abs. in Zool. Jahresber., 1896, Arthropoda, p. 45*).

A glossary of entomology, L. FAILLA-TEDALDI (*Bol. Naturalista, 17 (1897), No. 6, pp. 76, 77*).—A continued article that may be of use to readers of Italian entomological literature.

Systematic and synonymical catalogue of the Hymenoptera thus far described: VIII. Sphegidæ, C. W. DE DALLA TORRE (*Catalogus Hymenoptorum hucusque descriptorum systematicus et synonymicus. VIII. Fossorus (Sphegidæ). Leipsic: Engelmann, 1897, pp. 749; abs. in Zool. Centbl., 4 (1897), No. 17, pp. 494, 495*).—This takes in the group of digging wasps in its widest sense, *i. e.*, the 3 families Heterogynæ, Pompilidæ, and Sphegidæ, with over 9,000 species. The author recognizes 6 families among them, viz, Mutillidæ, Thynnidæ, Scoliidæ, Sapygidæ, Pompilidæ, Crabronidæ.

A preliminary classification of the species of the genus Acronycta of temperate North America, J. B. SMITH (*Ent. News, 8 (1897), No. 6, pp. 146–153*).

Researches on the morphology of Simondsia paradoxa, and some other nematodes parasitic in Sus scrofa, G. P. PIANA (*Atti Soc. Ital. Sci. Nat., 1897, Jan.; abs. in Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No. 22, 23, p. 887*).

Contributions from the New Mexico biological station: V. Some new Hymenoptera from the Mesilla Valley, New Mexico, T. D. A. COCKERELL (*Ann. Mag. Nat. His., 6. ser., 19 (1897), No. 112, pp. 394–403*).—*Centris cæsalpiniæ* n. sp., *C. cæsalpiniæ rhodopus* n. var., *C. hoffmanseggiæ* n. sp., *Perdita erigeronis* n. sp., *Podalirius lesquerellæ* n. sp., *Alcidamea biscutellæ* n. sp., *Chrysis bigeloviæ* n. sp., *Ammoplanus salicis* n. sp., *Spilochalcis mesillæ* n. sp.

Antennal structure of certain Diplosids, E. P. FELT (*Psyche, 8 (1897), No. 249, pp. 3–5, pl. 1*).—Notes peculiar arched filaments arising from the bases of the terminal and penultimate segments of the antennæ of the male *Diplosis pyrivora*.

The evolution of the cœlomic gregarines of the house cricket, L. CUENOT (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 1, pp. 52–54*).

Life history of Euchætes eglenensis and comparison with Collaris, H. G. DYAR (*Psyche, 8 (1897), No. 253, p. 70*).

On the biology of Camarota flavitarsis, P. MARCHAL (*Ent. Monthly Mag., 2. ser., 33 (1897), No. 86, pp. 30, 31*).

On Phimophorus spissicornis, A. HANDLIRSCH (*Verhandl. k. k. zool. bot. Gesell. Wien, 47 (1897), No. 6, pp. 408–410, figs. 2*).—This hemipteron is described and thought of sufficient importance to be the representative of a new family bearing the name of Phimophoridæ, characterized thus: Head long, cylindrical, crown between the antennæ not prominent. Proboscis strong, embedded in a deep furrow, 3-jointed, with a hook-like terminal joint. Antennæ inserted at the end of the head, 4-jointed, strong; the third joint most, the fourth least developed. Ocellary noticeable. Eyes in the middle of the side of the head. Body not much depressed. Prothorax nearly trapeziform, scutellum triangular, free. Breast flat, the coxal grooves at the hinder end of the prosternum. Legs long and strong, the anterior ones not modified for raptorial purposes. Tarsi 2-jointed, anterior wings with well-developed clavus; chorium and membrane not separated. Posterior wings with hamus. Abdomen strongly rounded below, above somewhat concave. The 7 ventral (genital) segments of the female externally as in Phymatidæ. Habitat similar to Oxythyreus (Phymatidæ) or Spathoccra (Coreidæ).

Some ants and myrmecophilus insects from Toronto, G. B. KING (*Canadian Ent., 29 (1897), No. 5, pp. 100–104*).

Note on Bruchus flavimanus, P. TERTRIN (*L'Apiculteur, 41 (1897), No. 2, pp. 79, 80*).

The value of peroxid of hydrogen in the preparation of entire insects, C. E. HANAMAN (*Amer. Monthly Micros. Jour., n. ser., 18 (1897), No. 1, pp. 7–9*).—For bleaching dark microscopic objects.

On mounting minute insects, particularly micro-lepidoptera, C. F. BAKER (*Psyche, 8 (1897), No. 253, pp. 63, 64*).

The direct photographic enlargement of entomological specimens, T. A. G. STRICKLAND (*Ent. Monthly Mag., 2. ser., 33 (1897), No. 88, pp. 84–86, fig. 1*).

Aphids and coccids associating with ants, G. B. KING (*Ent. News, 8 (1897), No. 6, pp. 125–129*).

Diagnosis of two new French species of Ptinus (Bruchus), E. A. DE PERRIN (*Bul. Soc. Ent. France, 1897, No. 7, pp. 131, 132*).—*Ptinus pubens* and *P. superbus*.

North American Apterygogenea, H. SCHÖTT (*Proc. California Acad. Sci., 2. ser., 6 (1897), pp. 169–196, pls. 3*).—Fourteen new species are described belonging to the genera Sminthurus, Tomocerus, Lepidocyrtus, Cremastocephalus, Entomobrya, Templetonia, Machilis, and Lepisma.

Revision of the Truxalinæ of North America, J. MCNEIL (*Proc. Davenport Acad. Sci., 6 (1897), pp. 179–274*).

The structure of the nest of Osmia bicolor, H. FRIESE (*Ent. Nachr., 23 (1897), No. 8, pp. 113–116, fig. 1*).—Builds its nest in April and May in snail shells of pine needles, and constructs so far as observed 3 cells. The nectar for its brood is obtained from Erica, Viola, and Lotus, the pollen from Crocus and Potentilla. The insect can scarcely be said to form a colony. As a rule the nests containing mostly females have one male in the outermost cell. The parasite noted was *Chrysis trimaculata*.

Notes on predaceous Heteroptera, with Uhler's description of two species, A. H. KIRKLAND (*Canadian Ent., 29 (1897), No. 5, pp. 115–118*).

How to winter bees in central Illinois, C. P. DADANT (*Amer. Bee Jour., 37 (1897), No. 39, pp. 610, 611*).—For the latitude of central Illinois wintering out of doors with a shelter of forest leaves packed around 3 sides of the hive, held in place by a sort of lattice work of lath and twine. The front or south side of the hive is left uncovered. A little farther north cellar wintering would be best.

How far do bees travel for honey? C. P. DADANT (*Amer. Bee Jour., 37 (1897), No. 38, p. 593*).—The author says, "Whatever other people's bees may do, ours will not thrive on a honey-crop source located 2 miles or more from them."

Renewing queens, BELLOT (*L'Apiculteur, 41 (1897), No. 4, pp. 144–147*).

The thirst of bees, C. DADANT (*Rev. Internat. Apiculture, 19 (1897), No. 2, pp. 26–28*).—From his experience in receiving bees and queens from a long distance the author concludes that bees do not require water in shipping. Bees and queens that had been supplied with water either in comb cells or sprayed over the comb arrived dead, while those that had been supplied with honey simply arrived in good condition. There is sufficient moisture arising from the respiration of the bees to aid them in liquefying the candied honey supplied them.

The prevention of swarming, W. P. FAYLOR (*Amer. Bee Jour., 37 (1897), No. 24, pp. 370, 371*).—It is claimed that simply raising the hive about a half inch so as to allow the cold air to enter the brood chamber more freely is a sure cure. It is explained that it is the author's belief that the cause of swarming is the overcrowding of some apartment of the queen's chamber.

The bees of Europe (Apidæ europæae) according to their genera, species, and varieties, etc.: III. Genus Podalirius (*Berlin: R. Friedländer & Sohn, 1897, pp. 316, figs. 61; abs. in Zool. Centbl., 4 (1897), No. 15, pp. 531, 532*).

The bees of Borneo and the East, G. D. HAVILAND (*Amer. Bee Jour., 37 (1897), No. 32, pp. 501, 502*).—Notes on *Apis florea, A. dorsata, A. indica,* and *A. flava.*

Bees hanging out—new drawn foundation, E. R. ROOT (*Amer. Bee Jour., 37 (1897), No. 31, pp. 484, 485*).

Factors influencing the cause of swarming, L. A. ASPINWALL (*Amer. Bee Jour., 37 (1897), No. 33, p. 517*).

What shall we plant for honey? L. R. LIGHTON (*Amer. Bee Jour., 37 (1897), No. 22, pp. 341, 342*).—The following are recommended: Apple, apricot, almond, banana, blackberry, cherry, cranberry, currant, gooseberry, grape, Juneberry or service berry, nectarine, medlar, orange, peach, pear, plum, persimmon, quince, raspberry, and strawberry.

Sweet clover for honey and forage, J. S. SLEETH (*Amer. Bee Jour., 37 (1897), No. 29, p. 451*).—Over 1,500 lbs. of honey from 22 colonies.

Has temperature an influence on foul brood? E. BERTRAND (*Rev. Internat. Apiculture, 19 (1897), No. 7, pp. 125–127*).—The author takes exceptions to the statements made by E. Regnier, of Boufarik, that hives transported from France to Algiers are never seized with foul brood, while those transported in the opposite direction are attacked. Bertrand states that decaying brood does not give rise to the disease and in support of his assertion quotes Dadant as saying that he has not met with the disease in Illinois where, following Regnier's argument, one might expect it. Further, a case is cited where foul brood was introduced from Austria into Palestine—a country equally as warm and dry as Algiers.

Description of the bot fly of the cotton-tail rabbit in New Mexico, C. H. T. TOWNSEND (*Psyche, 8 (1897), No. 249, pp. 8, 9*).—*Cuterebra lepusculi* n. sp.

Some common injurious plant lice with suggestions for their destruction, W. G. JOHNSON (*Maryland Sta. Bul. 48, pp. 89–101, figs. 8*).—The subject is introduced by stating that very considerable losses have occurred in various parts of the State from the ravages of the melon plant louse during the past season. One person stated that he had lost over $1,000 worth of cantaloupes during the past summer, and estimates made by the author that a district comprised within a radius of 2½ miles from Edwin suffered a loss of from $5,000 to $6,000. In another district the loss is computed at $10,000 and for the whole county of Somerset at $25,000 and for the whole State at over $100,000. A general statement of the characters of plant lice in general is given and then the melon plant louse (*Aphis gossypii*), the cabbage louse (*Aphis brassicæ*), the black peach louse (*Aphis persicæ-niger*), and the cherry louse (*Myzus cerasi*) are discussed more or less in detail and the proper preventive and remedial measures noted, as also natural enemies. Relative to the melon plant louse, which is discussed in greatest detail, the importance of beginning early is insisted upon and of keeping fields, fence corners, and roadways perfectly clean as well as of cooperation among neighbors in the work of destroying the pest. The work should be begun in autumn by raking up and burning all the old vines as soon as the melons have been gathered. This should be followed by burning the weeds in fence corners and along the roadsides, and by plowing weedy fields.

In the spring the young plants should be sprayed with kerosene emulsion as soon as the insects appear. The apparatus for this work is noted.

Similar remedies are recommended for the black peach louse, the kerosene emulsion used being diluted 10 or 12 times with water or 1 lb. whale-oil soap and 6 gal. water used.

Animal enemies of the field, orchard, and vineyard, FRANK and SORAUER (*Arb. deut. landw. Gesell., No. 26. Jahresber. Sonderaussch. Pflanzenschutz, 1896, pp. 13–26*).—Among the large number of animals enumerated as injurious during 1896 are included *Julus terrestris* as injuring grains, myriapoda as damaging beets, and *Libellula quadrimaculata* as injuring grains. The last were injurious through large numbers resting on the plants.

Notes on the longicorn genus Glenea, with descriptions of new species, C. J. GAHAN (*Ann. Mag. Nat. Hist., 6. ser., 19 (1897), No. 113, pp. 473–494*).—The structure of the tarsal claw and sexual dimorphism are considered. The new species *Glenea zalinensis, G. alucusis, G. subsimilis, G. propinqua, G. siamensis, G. albofasciata, G. mallacei, G. lineata, G. assimilis, G. gratiosa, G. grisioguttata, G. papuensis, G. cœlestina, G. suturalis, G. chlorospila, G. signotifrons,* and the new genus *Heteroglenia* are described.

Notes on New England Acridiidæ. III. Œdipodinæ, I–VI, A. P. MORSE (*Psyche, 8 (1897), Nos. 249, pp. 6–8; 251, pp. 35–37, pl. 1; 252, pp. 50, 51; 253, pp. 64–67; 254, pp. 80–82; 255, pp. 87–89*).

Leucania unipuncta, C. G. SOULE (*Psyche, 8 (1897), No. 249, p. 11*).—It is noted that the moths of this species were exceedingly abundant during the summer of 1896 in the vicinity of Cambridge, Massachusetts. Clouds of them were also seen by fishermen out at sea. In Brookline, Massachusetts, the larvæ were very abundant in the fall of 1896, and were preyed upon by blue jays, golden-winged woodpeckers, and chickadees.

Insect injury to violet leaves, P. H. DORSETT (*The Florists' Exchange, 9 (1897), No. 43, p. 975, fig. 1*).—Notes attacks of the larvæ of *Phlyctænia ferrugalis* on leaves of violets.

Climbing cutworms in western New York, M. V. SLINGERLAND (*New York Cornell Sta. Rpt. 1895, pp. 641–685, pls. 5, figs. 2*).—Reprint of Bulletin 104 of the station (E. S. R., 8, p. 64).

The cigar case bearer in western New York, M. V. SLINGERLAND (*New York Cornell Sta. Rpt. 1895, pp. 285–301, figs. 11*).—Reprint of Bulletin 93 of the station (E. S. R., 7, p. 227).

Insects injurious in 1896, O. LUGGER (*Minnesota Sta. Rpt. 1896, pp. 32–257, pls. 16, figs. 187*).—A reprint of Bulletin 48 of the station (E. S. R., 9, p. 149).

Scale insects and how to combat them [Continued], H. G. BURNETT (*Jour. Jamaica Agr. Soc., 1 (1897), No. 10, pp. 363, 364*).

Two forms of fluted scale, T. D. A. COCKERELL (*Psyche, 8 (1897), No. 255, p. 94*).—On *Icerya purchasi maskelli* and *I. purchasi crawii* from California.

A new subfamily in the Jassidæ, C. F. BAKER (*Psyche, 8 (1897), No. 254, pp. 76, 77*).—Kœbelinæ, n. subfam., and *Kœbelia californica* n. gen. and n. sp.

Notes on new Coccidæ, T. D. A. COCKERELL (*Psyche, 8 (1897), No. 252, pp. 52, 53*).—*Lecanium flaveolum* n. sp. is described as a new greenhouse pest and *Leucaspis japonicus* n. sp. as one quarantined at San Francisco.

Our street trees and the elm leaf beetle, W. E. BRITTON (*Gard. and Forest, 10 (1897), No. 495, pp. 326–327*).—Complaint is made that people take no notice of trees until they are being destroyed. At New Haven in 1896 the elm trees were sprayed by the authorities in some cases as many as 3 times. The park trees and those in the central part of the city were first treated. The effect as seen this year was good. To avoid expense the plan is suggested of spraying only one-half of the trees each season.

Beetles that destroy forests, E. MORLEY (*Ent. Record and Jour. Variation, 9 (1897), No. 2, pp. 32–35*).—Popular notes on *Hylurgus piniperda, Hylastes ater, H. palliatus, H. obscurus, H. crenatus, H. fraxini, Phlœophorus rhododactylus, Scolytus destructor,* *S. intricatus, S. multistriatus, Cryphalus abietis, Xyleborus saxeseni, Pityophthorus micrographus,* and *Tomicus typographus.*

New and little known Coccidæ from Florida: I. Determinations and descriptions, including a new genus, T. D. A. COCKERELL (*Psyche, 8 (1897), No. 255, pp. 89, 90*).—Pseudophilippia, n. gen., *P. quaintancii,* n. sp., and *Lecanium parvicorni,* n. sp., are described.

Greenhouse Orthoptera, S. H. SCUDDER (*Psyche, 8 (1897), No. 253, p. 71*).—The three cases known are a species of Copiophora, one of Bliastes, and *Apithes agitatrix.*

A southern race of Datana perspicua (var. mesillæ), T. D. A. COCKERELL (*Psyche, 8 (1897), No. 251, p. 41*).

Description of some new genera in the family Cynipidæ, W. H. ASHMEAD (*Psyche, 8 (1897), No. 253, pp. 67, 70*).—The new genera are Acanthægilips, Biorrhiza, Sphæroteras, Trichoteras, Aulacidea, Gonaspis, and Gilletta. The new species are *Acanthægilips braziliensis, Trichoteras coquilleti,* and *Gillettea taraxaci.*

A State in arms against a caterpillar, F. OSGOOD (*Harper's Monthly Mag., 95 (1897), No. 567, pp. 458–465, figs. 4; rev. in Review of Reviews, 16 (1897), No. 91, pp. 206, 207*).

Delarvation, P. TERTRIN (*L'Apiculteur, 41 (1897), No. 3, pp. 113–119*).—The history of the subject is briefly reviewed and modern French legislation (law of 1888) and processes noted.

The destruction of the white grub, P. TERTRIN (*L'Apiculteur, 41 (1897), No. 4, pp. 165–168*).—Among the remedies noted are crude naphthalin used at the rate of 400 gm. for each square of 20 to 25 cm., benzin, and ammonia.

Destruction of Luperus flavipennis, MENEGAUX and COCHON (*L'Apiculteur, 41 (1897), No. 4, pp. 164*).—Besides Riley's formula for kerosene emulsion the following of Vassilière is given: Black soap, 2 kg.; sodium carbonate, 1 kg.; petroleum, 1 liter, and water, 100 liters. The mixture is prepared warm with 20 liters of water and finally the rest of the water added.

The employment of calcium carbid to destroy the phylloxera (*L'Apiculteur, 41 (1897), No. 8, pp. 333–335*).

Hydrocyanic gas for greenhouse fumigation, P. H. DORSETT (*Florists' Exchange, 9 (1897), No. 41, p. 915, figs. 2*).—The advantages of the gas over other insecticides are summarized and an improvement of the older methods of using it in greenhouses suggested. This consists of a series of strings reaching to the door. To the inner ends of these the potassium cyanid is suspended in paper bags (using two of the bags to insure against one giving away on account of moisture gathered by the cyanid before all is ready and thus endangering the life of the experimenter) over dishes containing the necessary acid. When all is ready merely releasing the ends of the strings near the door drops bags into the acid. His nearness to the door allows the experimenter to escape. The method should not be used unless the external temperature is sufficiently high to allow of the houses being ventilated for as much as 30 minutes after the experiment.

Notions about the spraying of trees, with remarks on the cankerworm, L. H. BAILEY (*New York Cornell Sta. Rpt. 1895, pp. 570–590, figs. 6*).—Reprint of Bulletin 101 of the station (E. S. R., 7, p. 879).

Studies in artificial cultures of entomogenous fungi, R. H. PETTIT (*New York Cornell Sta. Rpt. 1895, pp. 417–465, pls. 11*).—Reprint of Bulletin 97 of the station (E. S. R., 7, p. 412).

Cordyceps entomorrhiza (Dickson), a vegetable enemy of Hepialis lupulinus larvæ, F. V. THEOBOLD (*Entomologist, 30 (1897), No. 409, pp. 162–165, figs. 3*).—It is noted incidentally that experiments to infect other areas than those already infected with the spores of the fungus have not thus far been very successful.

An unlawful pursuit, T. G. NEWMAN (*Amer. Bee Jour., 37 (1897), No. 3, p. 36*).—In his report of the twelfth annual meeting of the National Bee Keepers' Union, the author notes that an attempt was made by the Trustees of Marine, Illinois, to secure the passage of an ordnance prohibiting the keeping of bees in the town, inasmuch as they punctured fruit.

Contributions to the knowledge of extra European Œstridæ and parasitic Muscariæ, F. BRAUER (*Denkschr. Math. Nat. K. Ak. Wiss. Wien, 64 (1896), pp. 26, pl. 1; abs. in Zool. Centbl., 4 (1897), No. 13, pp. 455, 456*).

The parasites of ants (*Scient. Amer., 77 (1897), No. 17, p. 251*).—On *Antennophorus uhlmani*.

FOODS—ANIMAL PRODUCTION.

The composition of prepared cereal foods, E. E. SLOSSON (*Wyoming Sta. Bul. 33, pp. 71–84*).—The author reports analyses of the following breakfast foods: Wheatena, Wheat Manna, Pettijohn's Breakfast Food, Farinose, Farina, Cracked Wheat, Germade, Wheatlets, Sioux Wheat Flakes, Ralston Breakfast Food, Durkee's Glutena Food, Fould's Wheat Germ Food, and Golden Sheaf Wheat Flakes, prepared from wheat; oatmeal in bulk, Quaker Oats, Hornby's Oatmeal, Cormack's Nudavene, Buckeye Rolled Oats, and Douglas & Stuart's Rolled Oats, prepared from oats; and Cerealine and Velvet Meal, prepared from corn. The fuel value of the foods was determined by combustion in a Mahler bomb. The price per pound of the different foods is given.

"The chemical analyses and examination of the starch grains with the microscope showed no evidence of the presence of foreign cereals, so adulteration may be regarded as absent in foods of this class. . . .

"There is more variation in price than in composition, and there is no discoverable relation between quality and price. Some articles are four or five times the cost of others of the same class and apparently of the same merit. The oatmeal sold in bulk is practically the same in composition and, so far as can be judged by personal taste, in quality and flavor as that sold in packages for several times the price. Of course in buying bulk articles one is not so sure of getting the same grade or that the quality has not been injured by long keeping and exposure. . . . The chief advantages of package goods is that the manufacturer is made directly responsible to the consumer. . . .

"The claims made for quick cooking are generally fallacious. Almost all such preparations should be cooked for at least half an hour and usually longer to insure the complete digestibility of the starch."

The nutritive value of rye flour of different sorts obtained by modern methods of grinding, E. ROMBERG (*Arch. Hyg., 28 (1897), No. 3, pp. 244–290*).—Experiments were conducted with men to determine the digestibility of bread made from a large number of different sorts of rye flour. In each experiment for a number of days the diet of the subject consisted of bread with a little butter. Beer was consumed as a beverage. The feces were separated with milk. The composition of the different flours used is given and the results of the digestion experiments are expressed in full in tabular form. Among the conclusions reached were the following: When a considerable portion of the bran is ground with the rye, the digestibility of bread made from the flour diminishes and this is the case even if the flour is very finely ground; that is, bran has little value as a nutrient. Under the most favorable circumstances it can not be entirely assimilated. The ash content of rye flour is a criterion of its value. Bread always had a higher ash content than the flour from which it was made. The protein, ash, and fat content of the feces from the different sorts of bread varied within narrow limits. Persons who are accustomed habitually to consume large amounts of carbohydrates, especially bread, digest bread better than those who are accustomed to eat large quantities of meat. Well-baked bread from the finest rye flour was as well assimilated as wheat bread.

The chemical composition of the feces on different diets, W. PRAUSNITZ (*Ztschr. Biol., 35, No. 3, pp. 335–354*).—A number of experiments are reported in which the composition of the feces was determined.

Among the conclusions reached were the following: When the diet consists of foods which are almost completely absorbed, as rice, meat, bread, etc., the composition of the feces is independent of that of the food and is practically uniform. When the food is less completely absorbed the nitrogen content of the feces usually diminishes. Under ordinary circumstances the chemical composition of the feces is never the same as that of the food but generally has a high nitrogen content. There is no especial difference in the assimilation of animal and vegetable nutrients in the human intestinal tract. The assimilation is dependent solely upon the method of preparation. In these experiments rice and foods made from fine flour were most thoroughly assimilated, only traces being found in the feces. Somewhat larger quantities of undigested residue of meat were found even under the most favorable circumstances. With few exceptions human feces are chiefly made up of intestinal secretions, and not of undigested residue.

The vegetable matter in human feces, J. MOELLER (*Ztschr. Biol., 35, No. 3, pp. 291–315*).—The author studied with a microscope the composition of feces on a vegetable diet. Small portions were diluted with considerable water, filtered, and repeatedly washed until a colorless filtrate was obtained. The portion remaining on the filter was examined.

Among the conclusions reached were the following: In the case of healthy individuals the starch of cereals and potatoes is almost completely digested, even if the starchy food materials are not in the most favorable mechanical condition, as in the case of rice or slices of potato. Some starch escapes digestion when consumed in such foods as legumes or green vegetables. The thick cells of ripe legumes, although composed of almost pure cellulose, were apparently not at all digested. On the other hand, the starch of unripe legumes appeared to be almost as completely digested as that of the cereals. The seed coat of legumes and the gluten layer of cereals are not at all digested, although composed of almost pure cellulose. The same is true of the protein and fat inside the cells in the gluten layer of cereals unless the cell walls are broken. The amount of gluten in cereals materially affects their digestion. The characteristic cells and tissues of vegetables are found in more or less quantity in the feces, and it is possible to identify fragments from any vegetable diet consumed.

A very complete review of the literature of the subject is given.

The excretion of flesh in human feces and an attempt to determine its amount, F. KERMAUNER (*Ztschr. Biol., 35, No. 3, pp. 316–334*).—By somewhat similar methods to those noted in the preceding abstract the author studied the composition of the feces in a number of cases where the subjects consumed a meat diet. From the results of his microscopic examinations he devised a method for determining the amount of nitrogen in the feces due to undigested flesh.

The feces were found to contain cells from the muscular tissue of the meat eaten, but the amount of such material was sufficient to account for only a small part of the nitrogen present; that is, the nitrogen of the feces is largely due to nitrogenous metabolic products excreted by the intestines. The author believes that when meat is consumed under ordinary conditions in a mixed diet it always furnishes a portion of the nitrogen of the feces, but that the amount varies and can not be even approximately expressed by average figures.

The literature of the subject is reviewed by the author.

Intestinal excretion of nitrogen, J. TSUBOI (*Ztschr. Biol., 35, No. 1, pp. 68–93*).—The author made 3 experiments with a dog to determine the amount of metabolic products in the feces. In the first experiment the dog received no food; in the second experiment the daily ration consisted of a cake made from 70 gm. starch, 50 gm. fat, and 12 gm. sugar; and in the third experiment a cake made from 200 gm. starch, 80 gm. fat, and 25 gm. sugar. The feces were separated by feeding bones. The nitrogen, fat, and ash in the feces were determined, and in the second and third experiments the starch also. The results of the experiments are briefly summarized as follows:

Average dry matter in food and dry matter and nutrients in feces per day.

	Duration of experiment.	In food.	In feces.				
		Dry matter.	Dry matter.	Nitrogen.	Fat.	Starch.	Ash.
	Days.	*Grams.*	*Grams.*	*Gram.*	*Grams.*	*Grams.*	*Grams.*
First experiment	10	0	2.64	0.14	0.67	0	0.61
Second experiment	9	132	5.81	.24	1.64	0.57	.76
Third experiment	6	305	12.92	.57	1.43	3.60	1.04

The author drew the following conclusions: The consumption of nitrogen-free food increased the excretion of nitrogen in the feces, the increase being proportional to the amount consumed. When nitrogen free food was consumed the nitrogen excretion in the feces was as large as other investigators have found when a considerable amount of meat was consumed. Therefore, when either animal food or a number of vegetable foods are consumed the nitrogen in the feces must be derived largely from metabolic products. The fat and starch were almost completely assimilated. In the first experiment all the material excreted in the feces came from the body. In the second experiment the author calculates that 4.27 gm. or 74 per cent per day of the feces came from the body, and in the third experiment 8.56 gm. or 66 per cent. The percentage of nitrogen in the dry matter of the feces was 5.11 in the first experiment, 4.17 in the second, and 4.35 in the third, being almost the same whether no food or an abundance of nitrogen-free food was consumed. When animal food or many vegetable foods are consumed the greater part of the feces is believed to consist of metabolic products. Therefore, since so much metabolic nitrogen leaves the body in the feces it is not sufficient to consider only the nitrogen excretion in the urine in determining the amount of protein required by the body, or similar problems. In all such problems a considerable amount of metabolic nitrogen in the feces must be taken into account.

The author reviews at length the work of previous investigators on the excretion of metabolic nitrogen and other products in the feces and compares his results with those obtained by others.

Contribution to the question of the formation of hippuric acid in the animal organism, T. PFEIFFER and W. EBER ET AL. (*Landw. Vers. Stat., 49 (1897), No. 1–2, pp. 97–144*).—The authors made a number of experiments with horses on the formation of hippuric acid. The influence of pentoses and of the putrefaction of protein on the formation of hippuric acid and similar questions were studied.

Among the conclusions reached were the following: The putrefaction of protein can not be regarded as the sole source of the nitrogen-free components of hippuric acid. The pentoses have an influence upon the formation of hippuric acid, though some other factor which has not hitherto been taken account of is concerned in it also. More definite conclusions could not be drawn from the present experiments. The authors are continuing their investigations.

Chronic oxalic acid poisoning, W. CASPARI (*Inaug. Diss., Berlin; abs. in Centbl. agr. Chem., 26 (1897), No. 8, pp. 529–533*).—The author made a number of experiments with rabbits on the effect of feeding beet leaves and a ration to which oxalic acid neutralized with calcium carbonate or sodium carbonate was added. The following deductions were drawn from the results: Food containing oxalic acid in small quantity and in a comparatively insoluble form is not harmful if fed for a short time, but is beneficial, since it improves the appetite. When fed in large quantities or in soluble form serious injury is caused and chronic oxalic poisoning induced. The addition of calcium carbonate to rations containing oxalic acid is regarded as a preventive of poisoning.

Experiments were also made with dogs. Oxalic acid was found to increase the excretion of calcium in the urine and feces.

The assimilation of iron, E. HÄUSERMANN (*Ztschr. physiol. Chem., 23, No. 6, pp. 555–592*).—The author reports experiments made with rats, dogs, cats, and children. From his experiments the deduction is drawn that iron is best absorbed as it occurs in animal and vegetable foods; that is, that iron which has formed a part of living tissue is better absorbed than chemical preparations. The iron content of a large number of foods is reported. In most cases the values were obtained by the author. In some instances they are quoted from the work of other observers.

Feeding experiments conducted at Mains of Laithers, 1895-'96, A. P. AITKEN (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 9 (1897), pp. 156-180*).—The author reports experiments by J. Milne with 5 lots of 2 year-old cattle on the relative value of a number of concentrated feeding stuffs. Each lot was made up of 6 steers and 4 heifers (8 cross-bred Irish and 2 home-bred polled cattle). One steer was dropped from lot 1 before the close of the test. The experiments began December 19, 1895, and covered 16 weeks. The cattle were fed in stalls. All the lots were given a basal ration of 50 lbs. per head daily of pulped yellow turnips and straw *ad libitum*. In addition, lot 4 was fed 10 lbs. of barley bran. In order that the feeding stuffs might be compared on a financial basis, the other lots were fed as much of the different concentrated feeding stuffs used as could be purchased for the same price as the barley bran. Thus, lot 1 received $7\frac{1}{4}$ lbs. per head of ground decorticated cotton-seed cake, lot 2 $3\frac{5}{6}$ lbs. ground decorticated cotton-seed cake and $5\frac{3}{4}$ lbs. dried brewers' grains, lot 3 $6\frac{2}{3}$ lbs. ground linseed cake, and lot 5 4 lbs. crushed oats and $4\frac{1}{2}$ lbs. ground corn. The nutritive ratio of the different rations was as follows: Lot 1 1:3, lot 2 1:4, lot 3 1:4.5, lot 4 1:7.4, and lot 5 1:10. The food consumed and for a number of weeks the urine and feces for 2 animals of each lot were analyzed. The composition of the urine, however, is not recorded. The average daily gain for the different lots was as follows: Lot 1 1.11 lbs., lot 2 1.33 lbs., lot 3 1.20 lbs., lot 4 1.42 lbs., and lot 5 1.26 lbs.

From the data obtained and Wolff's tables the coefficients of digestibility of the different feeding stuffs were calculated and are shown in the following table:

Coefficients of digestibility of feeding stuffs.

	Protein.	Fat.	Carbohydrates.	Crude fiber.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Decorticated cotton cake	85	80	95	....
Linseed cake	86	90	80	50
Dried brewers' grains	72	84	67	42
Barley bran	78	80	80	40
Oats	80	90	80	30
Oats straw	50	50	45	60
Maize	75	90	95	80
Turnips[1]	60	90	94	90

[1] Quoted from previous experiments.

The results of the experiments are discussed in detail. It is pointed out that barley bran, which is ordinarily exported, is a valuable feeding stuff. In the author's opinion the cattle as a whole did not make as large gains as might have been expected. This is explained on the ground of the inferior quality of the turnips and straw fed. The turnips were not well matured and contained a high percentage of amid nitrogen. The straw was not of an appetizing kind.

"The results show that the market prices of the feeding stuffs used are not in harmony with the feeding value—at least when consumed by cattle; that linseed cake, which is the most popular of the feeding stuffs, is also the dearest; that a mixture of decorticated cotton-cake meal and brewers' grains is more economical, and that the barley bran is more economical still.

"As regards the quality of the fodder as shown by the nutritive ratio, the experiments show that in this case both the very narrow ratio and the wide one were not economical, that the moderate ratios did best, but that within a moderate range there seems to be no absolute agreement between nutritive ratio and feeding progress. . . . It does not seem that the ratio most advantageous for feeding progress is capable of being so exactly defined as has been customarily taught from the results of feeding experiments conducted on the Continent."

Feeding experiments with sheep conducted at Ferney Castle and at Whitelaw, 1896, A. P. AITKEN (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 9 (1897), pp. 181–188*).—The author reports experiments made with sheep at these two places to compare a number of concentrated feeding stuffs. It was the intention to make experiments with sheep under practically the same conditions as those reported above with cattle. Each investigator experimented with 4 lots of 10 wethers each. The test made at Ferney Castle lasted 60 days and that at Whitelaw 35 days. All the sheep were fed a basal ration of hay and turnips *ad libitum*, but they consumed only small quantities of hay. In addition lot 1 received $5\frac{3}{4}$ lbs. of dried brewers' grains and $3\frac{5}{6}$ lbs. of ground decorticated cotton-seed cake, lot 2 $2\frac{2}{3}$ lbs. of ground linseed cake, lot 3 $11\frac{1}{4}$ lbs. of dried brewers' grains, and lot 4 $4\frac{1}{2}$ lbs. of ground corn and 4 lbs. of crushed oats. It was the intention to feed lot 3 barley bran, but the sheep refused to eat it, and dried brewers' grains were substituted.

At the close of the test the sheep were slaughtered. Analyses are given of the feeding stuffs used and the amounts of food consumed, the increase in live weight, the weights of the carcasses for each lot, and the tallow and wool from the lots fed at Whitelaw are recorded. The average gains in weight for the different lots were as follows: At Ferney Castle—lot 1 22 lbs., lot 2 22 lbs., lot 3 17.1 lbs., lot 4 14 lbs.; at Whitelaw—lot 1 10.3 lbs., lot 2 11.9 lbs., lot 3 14 lbs., lot 4 10.3 lbs.

The dressed weight of the sheep was more uniform, varying from 59.1 lbs. to 62 lbs. in the Ferney Castle lots, and from 59 lbs. to 62.4 lbs. in the Whitelaw lots.

"The most that can safely be said about the utility of the feeding stuffs is that, as tested by the sheep, there are no very marked differences observable."

Comparison of the value of sweet and sour whey for fattening hogs, G. E. DAY (*Ontario Agl. Col. and Expt. Farm Rpt. 1896, pp. 78–80*).—Two tests were made to compare the relative value of sweet and sour whey. The first test was made with 3 lots of 3 pigs each. After a preliminary period of 7 days, during which all the lots were fed the same ration, the test proper began August 22 and lasted 55 days. Lot 1 was fed meal (wheat and barley 1:1) mixed with water, lot 2 meal mixed with sweet whey, and lot 3 meal mixed with sour whey. At the beginning of the experiment proper the weights of the lots were 361.5 lbs., 365 lbs., and 381.5 lbs., respectively. The average daily gains per pig for the 3 lots were 1.23 lbs., 1.64 lbs., and 1.61 lbs. Lot 1 consumed 4.97 lbs. of meal per pound of gain, lot 2 3.72 lbs. of meal and 9.41 lbs. of sweet whey, and lot 3 3.8 lbs. of meal and 8.68 lbs. of sour whey.

The second test was begun with 3 lots of 3 pigs each, but 1 pig was dropped from lots 1 and 2 before the close of the test. The conditions of the second trial were the same as in the first. The experiment proper covered 42 days At the beginning of the test proper lot 1 weighed 320 lbs., lot 2 341.5 lbs., and lot 3 476 lbs. The average daily gains per pig made by the 3 lots were 1.63 lbs., 1.88 lbs., and 1.95 lbs., respectively. Lot 1 consumed 4.9 lbs. of meal per pound of gain, lot 2 3.9 lbs. of meal and 7.79 lbs. of sweet whey, and lot 3 3.85 lbs. of meal and 7.69 lbs. of sour whey.

In the author's opinion the results of the 2 tests indicate that sour whey has practically the same feeding value as sweet whey. The experiments will be continued.

Experiments with different breeds of hogs under different methods of treatment, G. E. DAY (*Ontario Agr. Col. and Expt. Farm Rpt. 1896, pp. 71–78*).—A test covering 2 periods was made with 36 pure-bred pigs divided into 3 lots. Each lot contained 2 pigs of each of the following breeds: Berkshire, Poland-China, Yorkshire, Chester White, Tamworth, and Duroc-Jersey. The pigs were about 3 months old at the beginning of the trial. The first period began June 18 and continued 1 month. In lot 1 the pigs of each breed were fed in separate pens 3 times a day all they would eat of meal of different sorts. Lots 2 and 3 were each turned into a clover pasture of about one-third of an acre, lot 2 receiving in addition one-half and lot 3 one-fourth the grain ration fed to lot 1.

The second period, which immediately followed the first, covered 3 months. Lots 1 and 3 were fed under the same conditions as lot 1 during the first period. Lot 2 was given the run of the 2 pastures and fed a full grain ration. The average cost of the different meals fed was assumed to be $14 per ton.

During the first period the average gain of the pigs in lot 1 was 17.54 lbs., of lot 2 5.79 lbs., and of lot 3 2.47 lbs. During the second period the average gain per pig for the different lots was 87.96 lbs., 109.46 lbs., and 98.83 lbs., respectively. The cost of the meal eaten per pound of gain by the different lots during both periods was 3.06 cts., 3 cts., and 2.84 cts., respectively. During the second period lot 2, on pasture and having considerable exercise, made greater gains than lot 3, and during the whole test made greater gains than lot 1. Not taking into account the value of the pasture, lot 3 made the most economical gains.

In the author's opinion the results of the experiment give little idea of the value of clover for pigs, since the clover was too far advanced to be satisfactory.

A record was kept of the gains made and food consumed per pound of gain by the different breeds in lot 1. All the pigs were sold and slaughtered and records kept of the slaughter test. The author does not think the data sufficient to draw conclusions relative to the different breeds.

Dietary hygiene for soldiers, DE FOURNÈS (*Jour. Hyg., 22 (1897), No. 1089, pp. 363–365*).—The author discusses a number of foods supplied to soldiers.

Domestic science in the agricultural colleges (*Amer. Kitchen Mag., 7 (1897), No. 6, pp. 213–223, figs. 9*).

Fodder analyses, C. L. PENNY (*Delaware Sta. Rpt. 1896, p. 159*).—Analyses are given of buckwheat bran, buckwheat hulls, buckwheat flour, buckwheat meal, buckwheat feed, oxeye daisy, and flea bane.

Composition of beans, lentils, and peas, BALLAND (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 2, pp. 119–121*).—The author reports analyses of beans, lentils, and peas.

Composition and feeding value of malt sprouts (*Deut. landw. Presse, 24 (1897), No. 58, p. 531*).—Quotation from an article by Remy in Wochenschr. Brauerei, 1897, July 16.

Composition of potatoes, BALLAND (*Jour. Hyg., 22 (1897), No. 1100, p. 498*).—The author reports the maximum, minimum, and average composition of potatoes, basing the figures on a large number of analyses of different varieties.

The potato as food, H. COUDON and L. BUSSARD (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 1, pp. 43–46*).—A condensation of an article published in An. Sci. Agron., 1897, I, No. 2, p. 250 (E. S. R., 9, p. 226).

The use of beet leaves for fodder, TANCRÉ (*Fühling's landw. Ztg., 46 (1897), No. 7, pp. 515–520*).—The author discusses the use of beet leaves for fodder before the beets are harvested and the effects of this practice on the crop. The feeding value of beet leaves is compared with the feeding value of grass and the value of field and sugar beet leaves for manure and silage is pointed out.

Experiments in feeding beet leaves, N. ZUNTZ (*Landwirt, 32 (1896), No. 74; abs. in Biedermann's Centbl. Agr. Chem., 26 (1897), No. 8, pp. 533, 534*).—The author discusses the question of feeding beet leaves, quoting the results of recent experiments.

Composition and digestibility of linseed meal, H. SNYDER (*Minnesota Sta. Rpt. 1896, pp. 20–23, fig. 1*).—Reprinted from Bulletin 47 of the station (E. S. R., 8, p. 615).

The composition of hay as affected by maturity, A. E. SHUTTLEWORTH (*Ontario Agr. Col. and Expt. Farm Rpt. 1896, pp. 32–34*).—The author gives the composition of clover and timothy hay cut at different dates and cured with and without exposure to the rain.

The results show "clearly a decrease in the percentage of water, and therefore in the succulency of the material, as maturity advances. Crude protein, like water, decreases considerably with maturity; but fiber, unlike water and protein, increases. . . .

"A comparison of the percentage composition of the water-free substance of the clover and timothy exposed to rain with that of the respective cuttings not exposed to rain, shows that rain acts chiefly on the nitrogen-free extracts and the amids, which to some extent are washed out. The explanation of this effect of rain and heavy dews on cured hay is that sugar (a constituent of the nitrogen-free extract) and amids are soluble in water."

Further investigations of prepared foods for children, together with brief remarks on the microscopical and bacteriological examination of such preparations, M. Blauberg (*Arch. Hyg., 30 (1897), No. 2, pp. 125–155*).—A continuation of previous work reported in Arch. Hyg., 27 (1896), No. 2, pp. 105–175 (E. S. R., 8, p. 330).

On the chemical composition of several nutritive salts (Nähsalze), together with brief remarks on the value of mineral matter for the organism, M. Blauberg (*Arch. Hyg., 30 (1897), No. 2, pp. 95–124*).

On the absorption of water by the gluten of different wheats, F. B. Guthrie (*Jour. and Proc. Roy. Soc. New South Wales, 30 (1896), pp. 124–134*).—See also Agr. Gaz. New South Wales, 7 (1896), No. 9, pp. 583–590 (E. S. R., 8, p. 514).

Classification of protein compounds, A. Wróblewski (*Centbl. Physiol., 11, pp. 306–308; abs. in Chem. Centbl., 2 (1897), No. 8, p. 525*).—The author divides protein compounds into 3 classes, (1) proteins, (2) compound proteins, and (3) albuminoids or substances similar to protein. The 3 classes are each subdivided. Several nitrogenous bodies are briefly discussed.

Artificial food preparations, G. Klemperer (*Deut. med. Wochenschr., 23 (1897), June 27; abs. in Dietet. and Hyg. Gaz., 13 (1897), No. 9, pp. 604, 605*).—The author discusses artificially prepared nitrogenous, fatty, and carbohydrate foods. He believes that in general the use of natural foods should be encouraged rather than that of artificially prepared foods.

The chemistry of soja sauce manufacture, Y. Nishimura (*College Agr., Tokyo, Bul., vol. 3, No. 3, pp. 191–206*).—The process of manufacture of soja sauce is described at length, and many analyses of the product in different stages are given.

A study of metabolism during fasting in hypnotic sleep, C. F. Hoover and T. Sollmann (*Jour. Expt. Med., 2 (1897), No. 4, pp. 405–411, pls. 2*).—The subject of this experiment remained in hypnotic sleep for 9 days, awaking only once during this period. He was supplied with water but consumed no food. The urine was collected with a catheter and analyzed. No feces were produced. During the whole period the subject excreted 113.617 gm. nitrogen. As the experiment progressed, the loss of phosphoric acid became greater in proportion to the amount of nitrogen. The uric acid excreted diminished on the first day but increased on the succeeding days.

"The chlorids gradually fell in amount, reaching the minimum on the last day.

"The total loss of the body weight was 5,896 gm. (nearly 13 lbs.), 3,341 of which must have been proteid material, as estimated in lean muscle from the amount of nitrogen lost. Assuming that the maximum amount of glycogen in the liver was 200 gm., which we may assume was all consumed, the loss in fat and water would be 2,355 gm."

The authors compare their results with those obtained in experiments with fasting men.

The bacteria in human feces when a vegetable and a mixed diet is consumed, H. Hammerl (*Ztschr. Biol., 35, No. 3, pp. 354–356*).—The author studied the bacteria of human feces in connection with the work reported on page 473.

On the separation of feces, M. Cramer and H. Neumayer (*Ztschr. Biol., 35, No. 3, pp. 391–393*).—The author recommends the use of pure silicic acid for separating feces.

The microscopic examination of the feces, von Ledden-Hulsebosch (*Arch. Pharm., 235 (1897), No. 6, pp. 429–435*).—The author urges the importance of such examination in many cases, and refers briefly to results of his own investigations.

A contribution to the knowledge of the nitrogenous constituents of human urine, especially the so-called alloxur compounds, W. Camerer (*Ztschr. Biol., 35, No. 2, pp. 206–251*).

The recent experiments supporting the theory of the formation of fat from protein, E. Pflüger (*Arch. gesam. Physiol. [Pflüger], 68 (1897), Nos. 3–4, pp. 176–190*).—A controversial article.

The mineral constituents of the organs of the human body, W. VON MORACZEWSKI (*Ztschr. physiol. Chem., 23 (1897), Nos. 4–5, pp. 483–496*).

Some observations on the chemistry of the contents of the alimentary tract under various conditions, and on the influence of the bacteria present in them, A. L. GILLESPIE (*Proc. Roy. Soc. [London], 62 (1897), No. 379, pp. 4–11*).—Experiments were made with a man, a calf, and a dog. The points studied were the reaction of the contents of the alimentary tract in its various parts, and the bodies to which this reaction is due; the amount of chlorin present and the nature of its combination; the amount of solids present; the action of ferments, and the number and nature of the bacteria.

Investigations on the formation of flesh in the sucking calf, J. J. O. DE VRIES, J. Zn. (*Untersuchungen über die Fleischbildung des Saug-kalbes. Inaug. Diss., Göttingen, 1896, pp. 80*).—This is a full account of experiments briefly reported in another publication.[1]

Early lamb raising, G. C. WATSON (*New York Cornell Sta. Rpt. 1895, pp. 163–192, figs. 2*).—Reprint of Bulletin 88 of the station (E. S. R., 7, p. 239).

Sheep breeding in Jamaica (*Jour. Jamaica Agr. Soc., 1 (1897), No. 10, pp. 353–357*).—The article gives information obtained by correspondence with a number of sheep breeders.

Feeding pigs, G. C. WATSON (*New York Cornell Sta. Rpt. 1895, pp. 195–207, figs. 4*).—Reprint of Bulletin 89 of the station (E. S. R., 7, p. 241).

Turkeys and how to grow them (*New York: Orange Judd Co., 1897, pp. 159, figs. 35*).—This is a compilation edited by H. Myrick. The following among other subjects are treated: Origin and natural history, breeds of turkeys, turkey growing as a business, care of breeding stock, laying and hatching, rearing the turkey chicks, fattening and marketing, and hindrances and diseases.

Practical poultry culture, R. DE ZAYAS ENRIQUEZ (*Avicultura práctica. Mexico, 1897, pp. 140, figs. 17*).—Among the topics treated are poultry raising in Mexico, its importance in Europe and the United States, a description of different breeds, etc.

Report of manager of poultry department, L. G. JARVIS (*Ontario Agr. Col. and Expt. Farm Rpt. 1896, pp. 211–220, figs. 17*).—This contains among other things brief accounts of the results of artificial incubation, feeding, and water supply, and a description of buildings and furnishings.

Annual reports of the Poultry and Pet Stock Associations of the Province of Ontario for 1896 (*pp. 80*).—This contains besides statistics on the poultry exhibition of January, 1897, a number of popular articles on poultry raising.

DAIRY FARMING—DAIRYING.

Dairy experiments, H. H. DEAN (*Ontario Agr. Col. and Expt. Farm Rpt. 1896, pp. 41–66*).—A large number of experiments in cheese and butter making are described.

Relation of fat in milk to quantity and quality of cheese (pp. 41–50).—A report of the third year's work on this question. In 1896 51 experiments were made from April to November, the milk used in each experiment being divided into 2 lots according to its fat content, and cheese made from each lot. The results for each experiment, showing the percentage of fat in the milk and whey, the yield of cheese, the loss of fat, the quality of the cheese, etc., are fully tabulated.

[1] Orgaan Ver. Oudleer. Rÿks. Landbouwschool, 9 (1897), No. 2, pp. 8–11 (E. S. R., 9, p. 169).

The following table summarizes the results, grouped according to the fat content of the milk employed:

Results of experiments in making cheese from milk of different richness.

	Fat content of milk.		Milk required to make 1 lb. of cheese.	Cheese produced per 100 lbs. of milk.	Cheese produced from 1 lb. of fat in milk.	Fat content of whey.
	Range.	Average.				
	Per cent.	*Per cent.*	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*
Group I	Below 3.	2.91	10.950	9.131	3.13	0.175
Group II	3.00 to 3.50	3.22	10.968	9.117	2.83	.200
Group III	3.55 to 4.00	3.81	9.879	10.172	2.66	.236
Group IV	4.05 to 4.50	4.29	9.162	10.914	2.53	.284
Group V	4.55 to 5.00	4.72	8.737	11.444	2.41	.473
Group VI	5.05 to 5.30	5.17	8.247	12.125	2.34	.350
Average			10.054	9.944	2.69	

"The main points to note are (1) the increased yield of cheese per 100 lbs. of milk as the fat increases, except as in Group II; (2) the decreased yield of cheese per pound of fat in the milk as the percentage of fat increases; (3) the increased percentage of fat in the whey as the fat in the milk increases. These results agree with those formerly obtained. But note exception in the yield of cheese in Group II, which we are unable to explain fully.

"The results of this year correspond with those for the previous 2 years, viz, the cheese made from the medium and poor milk lost a higher percentage in curing than did those made from richer milk. As explained previously, the only reason we can assign is that in the cheese made from the poorer milk there is a greater surface exposed for evaporation per 100 lbs. of green cheese."

The cheese was scored by 3 persons and the results are tabulated by months and summarized.

"The cheese made from H (rich) milk scored ahead in the months of August, September, and October. In the other months the cheese made from L (medium) milk scored higher. Some months the score was very even in the 2 lots of cheese. In cases where cheeses were kept for several months and were scored 2 or 3 times during the period, there is nothing to warrant the conclusion that cheese made from rich milk possesses better 'keeping qualities.'"

The application of the results to the payment of milk in practice is tabulated. The general conclusions from the cheese experiments are as follows:

"(1) An increased percentage of fat in the milk increases the quantity of cheese which may be made per 100 lbs. of milk in most cases.

"(2) The increase of cheese is not in exact proportion to the fat. One pound of fat in 3 per cent milk will make more cheese than a pound of fat in 4 per cent milk. The yield of cheese per pound of fat gradually decreases as the percentage of fat in the milk increases.

"(3) The yield of cheese is fairly uniform in proportion to the fat and casein in the milk. The casein may be represented by the addend 2.

"(4) The quality of the cheese is not determined by the percentage of fat in the milk. The fat is but one factor in the problem. Our experiments indicate that an excess of fat is of no advantage to the cheese. To make cheese from milk containing over 4 per cent of fat we advise cooking to about 100° and salting from quarter to half pound extra, to improve body and texture.

"(5) The loss of fat in the whey was greater from the richer milk.

"(6) As a fair basis for distributing proceeds among patrons of cheese factories, we recommend the percentage of fat + 2, or fat and casein system."

Ripening of milk before adding rennet (p. 51).—The results are tabulated of 13 experiments on this point made during July, August, and September.

"The test used was the 8 oz. with 1 drachm of rennet. The test varied from 12½ seconds to 31 seconds. So far as getting the cheese made more quickly, there does not seem to be any gain in time by ripening the milk more or less. If the milk is ripened a good deal it should be dipped in that much less time. If set 'sweet' it remains in the whey the longer. The main thing seems to be to ripen the milk to such a point that it will dip in from 2 to 3 hours, which will allow the curd to become properly cooked. In the spring curds should dip in from 2 to 2½ hours, and in a longer time as the season advances or if we wish to make longer-keeping cheese. . . . On September 8, when the milk was set sweet without any starter, it remained in the whey 5½ hours. This was a very poor cheese."

Temperature for renneting milk (pp. 51, 52).—The results of 14 trials made during September, October, and November in setting milk at temperatures from 72 to 96° are reported.

"Below 80° the time from setting to dipping and from dipping to salting was longer than in the vats set at normal temperature. The loss of fat in the whey was greater, the yield of cheese was less, and the quality of the cheese was poorer when the rennet was added below 80°. Between 80 and 90° the effect in these points was not marked. Above 90° the quality of the cheese does not appear to be quite so good; otherwise there is not much difference, except in the less time required for coagulation. These results correspond with those obtained in 1895.[1] . . . A temperature of 86° for the milk is recommended when the rennet is added, though no particular harm will result if it is added between 80 and 90°."

Effect of different quantities of rennet (pp. 52–54).—The results are reported of 16 experiments made in April, May, and June in which the quantity of rennet varied from 1 to 9 oz. per 1,000 lbs. of milk.

"The extra quantity of rennet caused the cheese to 'break down' more quickly, or, in other words, ripened the curd sooner. Below 3 oz. the time required from setting to dipping was a little longer than with quantities above 3 oz. From dipping to salting there was very little difference in the time required to mellow the curds, whether a large or a small quantity of rennet was used, indicating that at this stage of the ripening the work is done by other agencies than the rennet. Later on the rennet plays an important part—bacteriologists to the contrary.

"It will also be noticed that the loss of fat in the whey increased when an ounce of rennet was used and the yield of cheese was less. Makers should use sufficient rennet to cause coagulation in not more than 35 to 40 minutes. Longer time means loss."

Acid on curd at dipping (pp. 54, 55).—The results of 10 trials in which the hot-iron test was used indicated that "there is not much effect on time required for making the cheese, whether dipped sweet or with 1¼ in. of acid." The author advises "dipping with ⅛ to ¼ in. of acid in order to secure the best results."

Milling the curd (pp. 55, 56).—Nine experiments are reported on the stage at which the curd should be milled.

"Where curds are left from 2 to 3 hours after dipping and are then milled the loss of fat is much greater than when milled in from 1 to 1½ hours after dipping. There is apparently not so very much difference in the quality of the cheese, except in the

[1] Ontario Agr. Col. and Expt. Farm Bulletin 102 (E. S. R., 8, p. 1030).

2 cases (October 27 and 28), where a portion of each curd was left about 3 hours before milling. The score of these cheese was 91 and 92, as compared with 95 for cheese made from the same kind of curd milled 1¾ hours after dipping. We recommend milling in from 45 minutes to 1½ hours after dipping."

Effect of salt on curds (p. 56).—In 10 experiments made from May to November from 1 to 4 lbs. of salt was used per 100 lbs. of curd. The results on spring cheese indicated that about 2½ lbs. of salt should be used. Fall cheese salted with 3¾ and 4 lbs. of salt was "found to be good in body and texture. . . . The cheese salted 4 lbs. mellowed nicely between November 14 and December 26." It has been found in these and previous experiments that "curd made from milk rich in fat (4 per cent and over) may be salted much heavier than curds from average milk."

Salting curds one hour sooner than usual (pp. 56, 57).—Ten experiments reported on this point indicated that the yield of cheese per 100 lbs. of milk was usually increased, there was less loss from drippings and pressings, and the quality at time of making and the keeping quality were not injured by salting sooner than usual, allowing the curds to mature in the salt.

Temperature of curds at time of putting to press (pp. 57, 58).—In 14 experiments the curd was equally divided, one lot being put to press at temperatures ranging from 60 to 96°, and the other at between 80 and 85°. The results in yield of green and cured cheese and the scoring are tabulated.

"The scoring shows that there is not much difference in the quality of the cheese made in each trial, except in 3 cases where the temperature at time of putting to press was 92, 93, and 96°. These cheese were more open and not so good in texture."

Separating cream from milk containing high and low percentages of fat (p. 58).—In 21 trials of separating cream the milk averaged 4.03 per cent of fat in one lot and 3.29 in the other.

"To produce 1 lb. of cream from the rich milk, required 7.19 lbs. milk; and for 1 lb. of cream it required 7.28 lbs. of medium or poor milk. The percentage of fat in the cream from rich milk was 28.15 and from the other 23.99. These results agree with those of last year, in reference to which we stated that the 'richer milk does not produce a greater volume of cream, but it is richer in butter fat than the cream produced from the poorer milk. The machine governs the volume of cream.'"

Separating milk at different temperatures (pp. 58, 59).—A number of trials are reported of separating milk at 96, 130, and 160° in October and November, butter being made from the cream and scored.

"The 'grain' of the butter was not injured by separating at the higher temperatures and the flavor was slightly improved. These trials indicate 130° F. as giving best results in flavor of butter."

Jersey cows' butter (pp. 59, 60).—During September and October, 18 trials were made of setting the milk from pure-bred Jerseys by itself in comparison with the mixed milk of the remainder of the herd. In 2 trials the milk was creamed in the separator.

"Of the Jersey milk set and separated (1,593 lbs.), the loss of fat in skim milk was 3.75 lbs. or 0.23 lb. per 100 lbs. of whole milk; while in the rest of the herd the loss was 0.33 lb. of fat lost per 100 lbs. of whole milk set. The average percentage of fat in the whole milk from the herd, without the pure-bred Jerseys, was 3.69 during these experiments. The Jersey cow's milk averaged 5.03. The pounds of milk required to make 1 lb. of butter were 23.64 and 16.9 respectively. With both lots of cream at the same temperature, the cream from the Jersey cows took a longer time to churn and the butter was firmer. Some of the Jersey cream was churned at 2 to 4° higher temperature and yet the butter was firm in body and texture. . . .

"In grain the Jersey butter scored slightly ahead in the average of all scores (23.4, as compared with 23.2); but in flavor the score was 40.1 for the Jersey butter, as compared with 41 for the butter made from grade cows."

Effect of period of lactation on creaming of milk and quality of butter (pp. 60, 61).—During September, October, and December experiments were made in which the dairy herd was divided into 3 groups according to the stage of lactation. The milk was creamed in deep cold setting. The average percentage of fat in the skim milk was 0.7 per cent for the cows over 6 months advanced, 0.6 per cent for the cows between 2 and 6 months, and 0.41 per cent for the fresh cows. The loss of fat in buttermilk was 0.22, 0.237, and 0.17, respectively, for the different groups. The time required for churning increased with the period of lactation.

"The average score in flavor of the butter made from cows milking under 6 months was 40.9; for those milking over 6 months the score was 41.7, and for fresh milkers, made in December only, and scored January 2, the average score of flavor was 41.8. It would seem that there is not much in the theory that the butter is not so good in flavor when made from the milk of cows advanced in the period of lactation."

Loss of fat in skim milk from farmers' dairies (p. 61).—The results are summarized of tests of 100 samples of skim milk obtained from 36 farmers' dairies in the vicinity of Guelph during the spring and summer months. These show a large loss of fat in the skim milk by shallow pans and deep setting.

Temperature for ripening cream (pp. 61, 62).—Cream was ripened at an average of 74°, at 60°, and cooled to 48° and in 1 hour heated to 60° for ripening. The average results of a number of trials as shown by the scoring of the butter are tabulated.

"There is not much difference in the quality of the butter obtained by the three plans. There would seem to be no good reason for cooling the cream to a temperature of 48° or below and then warming it up to 60° to ripen. It is a lot of labor and expense for nothing. If the cream be cooled to churning temperature, a sufficient length of time before it is churned (say 1 to 2 hours), in order to allow the fat time to cool and harden, the body and texture of the butter will be all right."

Thick vs. thin cream for churning (p. 62).—

"The general results indicate about 25 to 30 per cent of butter fat in cream as giving the best results in easy and exhaustive churning. The butter made from cream averaging 18 per cent fat had higher flavor shortly after being made, but did not hold its flavor so well as butter made from cream averaging 28 per cent fat."

Pasteurized cream (pp. 62, 63).—Cream was pasteurized by heating at 160° in an ordinary shot-gun can. After cooling it was ripened with the aid of a starter. "The quality of the butter was improved by pasteurizing and it held the flavor more perfectly for a length of time."

Pure cultures vs. starters made from pasteurized skim milk (pp. 63, 64).—Experiments were made in ripening cream with Hansen's lactic ferment, Conn's B. 41, and a starter made from skim milk. Several experiments were also made with these cultures which had been transferred from one churning to another. The butter was scored twice. The results, showing the acidity developed in the cream and the scoring of the butter, are tabulated. The conclusions were as follows:

"(1) All the 'cultures' and 'starters' developed about the same amount of acidity in the cream.

"(2) In those lots where the cream was pasteurized, the butter scored higher soon after being made and held its flavor better.

"(3) Of the butter made from the 2 cultures in June, there was not much difference in the flavor. The butter made from a pasteurized skim-milk starter scored an average of about 1 point higher in flavor.

"(4) The butter made from the transferred cultures was much alike in flavor when first made, but the B. 41 seems to have held its flavor better—1.5 points.

"(5) The cultures used November 25 gave a scoring of 38 for Hansen's and 41 for B. 41. The transfers improved the flavor in this case. Hansen's seemed to give a yeasty flavor to the butter."

Effect of washing butter (p. 65).—The butter from 23 churnings made from June to September was divided into 3 lots in each case, one lot being not washed at all, another washed once, and a third washed twice. Samples of the butter were kept and scored from time to time. The results are summarized below:

Scoring of washed and unwashed butter.

	Unwashed.			Washed once.			Washed twice.		
	Flavor.	Grain.	Total score.	Flavor.	Grain.	Total score.	Flavor.	Grain.	Total score.
First scoring	42.0	23.6	95.0	42.13	23.75	95.6	42.90	23.73	95.70
Last scoring	34.6	24.0	88.2	38.30	24.00	90.0	38.00	24.00	91.80
Average for year	38.3	23.8	91.6	40.22	23.87	92.8	40.45	23.86	93.75

Five lots of butter—2 not washed, 2 washed once, and 1 washed twice—made in April, were sent to a commission merchant less than 3 weeks after making. One of the unwashed samples scored 100 and the other 90 points. The butter washed once scored 93 and 95 points, and that washed twice 95 points.

Effect of salt on the quality of butter (pp. 65, 66)—

"From May to October 26 trials were made with different quantities of salt on butter. The quantity varied from ¼ oz. to 1 oz. of salt per pound of butter. The average pounds of cream churned were 70.65, and the pounds of butter 19.31. . . .

"All the experimental butter was scored from 1 to 3 times in periods of 3 days to 3 months after being made.

"The average scoring of the butter salted ⅝ oz. and over was higher at the first time than the butter salted ½ oz. This of course is largely a matter of taste. However, the keeping quality of light-salted butter was not nearly so good."

The action of rennet on milk, CAMUS (*La Semaine Médicale, 17 (1897), p. 275; abs. in Chem. Ztg., 21 (1897), No. 77, Repert., p. 215*).—The author found, with Gley, that rennet acts upon milk at 0° C. Milk which had been kept for a long time with rennet at zero curdled almost instantaneously when 3 or 4 drops of dilute lactic acid (1 to 10) was added, while ordinarily, as is well known, a much larger quantity of lactic acid is required to curdle milk at ordinary temperature. Rennet previously dried could be heated to 100°, and even to 140°, without losing its activity if treated with water after cooling. As milk is readily sterilized, it was proposed to study the action of the sterilized ferment on sterilized milk. But aqueous extracts of rennet, when previously neutralized, are rendered inactive by a medium low heat. For example, distilled water has an unfavorable action on rennet at 40°, the amount of the rennet rendered inactive at this temperature increasing with the duration of the treatment and with the amount of water used.

The cause of the curdling of milk when heated, B. BARDACH (*Monatsh. Chem., 18 (1897), pp. 199–216; Chem. Ztg., 21 (1897), p. 290*).—The author made numerous experiments with milk and casein. As a result of his studies he concludes that the curdling of milk by heating is a complex process due to a change in the casein combined with the action of small amounts of acid formed from the lactose when milk is heated at high temperatures. The acid formed is unable to curdle the original unchanged casein, and it is only after the casein has been changed by heating that it is coagulated by the acid.

The occurrence of alcohol in milk, H. WELLER (*Forsch. Lebensmtl. Hyg., 4 (1897), p. 20; abs. in Chem. Ztg., 21 (1897), No. 77, Repert., p. 213*).—The examination of milk which had an irritating after-taste and which was produced by a large herd of cows at a distillery showed the following: Specific gravity at 15° 1.0335, solids 13.30, fat 3.89, alcohol 0.96 per cent. The concentrated food of the herd consisted of distillery waste (slump). The material causing the irritating after-taste of the milk could be expelled with steam, and could be obtained from the distillery waste in the same way.

The evidence is regarded as conclusive that perfectly fresh and sweet milk may contain alcohol when the cows receive food containing alcohol.

Food and milk production, E. A. SHUTTLEWORTH (*Ontario Agr. Col. and Expt. Farm Rpt. 1896, pp. 26–30*).—An experiment was made with 2 cows, an Ayrshire and a Holstein. The time, from April 2 to July 21, was divided into 5 periods, the cows being fed rations varying in richness in alternating periods. In the last period they were on pasturage, the Ayrshire receiving about 2 lbs. each of oil cake and chopped peas in addition, and the Holstein a little hay. The results, including the average composition of the milk in different periods, are tabulated.

"The Ayrshire in the second period, when she was abundantly fed, gave an average daily yield of 25.48 lbs. of milk, being 12 lbs. more than in the first, and 10 lbs. more than in the third periods, when she received insufficient nourishment. The average daily yield of milk by the Holstein in the second period, when she was insufficiently nourished, was 20.30 lbs., being about 10 lbs. less than in the first and nearly 7 lbs. less than in the third period, when she was abundantly fed.

"It is therefore manifest that the ration of straw, oats, and turnips diminished considerably the yield of milk, and that the ration of hay, oats, peas, bran, oil cake, and turnips considerably increased it.

"In the fourth and fifth periods each cow yielded practically the same quantities of milk; and the addition of peas and oil cake to the Ayrshire's ration of grass did not increase her yield over that of the Holstein. . . .

"The variations in the percentages of the constituents of the same cow's milk during the several periods are so little that they come in nearly every instance within the limit of experimental error. The food, therefore, has had, apparently, no effect on the composition of the milk."

Bacterial contamination of milk, F. C. HARRISON (*Ontario Agr. Col. and Expt. Farm Rpt. 1896, pp. 105–114, pls. 4*).—Studies were made on the germ content of milk, and contamination from the foremilk, from the animal and milker, from the air, and from the use of improperly cleaned dairy utensils. In each instance the number of germs from a cubic centimeter of the milk, the number of species, and a description of the species is given. The germ content of the milk of the college dairy ranged from 8,000 to 18,000 per cubic centimeter, while that of the milk sold in Guelph was found to range from 121,000 to 1,200,000.

"Notice is especially directed to the great difference between the number of germs in the mixed milk of a herd kept under cleanly conditions, immediately after milking, and the milk supplied to consumers in the city of Guelph."

The germ content of the foremilk, or first part of the milking, was compared with that of the rest of the milking. The first few streams from each teat were drawn into a sterilized flask. This contained from 18,000 to 54,000 germs per cubic centimeter of milk, while the balance of the milk contained 890 to 4,800 germs.

"The results clearly demonstrate the fact that by milking the first few streams from each teat onto the ground, or into a separate pail, contamination from the foremilk is in a large measure prevented."

Cows were milked under clean, rather dirty, and dirty conditions, and also after the flanks and udder of the cow had been moistened with a wet cloth. In each case the number of germs falling into a milk pail 12 in. in diameter during 1 minute was determined, and culture dishes were exposed beside the milk pail for 1 minute. The results are given, together with plates showing the cultures in the dishes. Under ordinary conditions there were about 8,000 to 17,000 germs, while when the flanks and udder of the cow were moistened with a wet cloth before milking from 640 to 2,300 germs fell into the pail.

Determinations were made by means of culture dishes of the germ content of stable air during bedding, feeding hay, cleaning up, etc., and 1 hour later. In the former case the number of germs which would fall into a 12 in. milk pail in 1 minute ranged from 12,000 to 42,000, while 1 hour thereafter the number ranged from 483 to 2,300.

"If the manure is not frequently and thoroughly cleaned out, it gets dry and small particles from it help to swell the number of germs in the air.

"Much benefit would ensue either from moistening the fodder, or from feeding and bedding an hour or so before milking commences, to allow the dust, etc., of the air time to settle. If all such work were finished even half an hour before milking, it would be a great improvement on what is now done in many stables."

Directions are given for the proper cleaning of dairy utensils; the milk cans with concave bottoms instead of convex are recommended, "as in the former case the milk drains into the center of the can, while in the latter some of it is left in a channel around the edge and can not be easily removed by the brush;" and the results are given of washing cans in different manner. In each case after the can had been washed and drained dry 100 cc. of sterile water was added, well shaken up in the can, poured into a sterile flask, and then submitted to bacteriological analysis. From improperly cleaned dairy utensils these washings contained from 230,000 to 800,000 germs per cubic centimeter; when the cans were washed in tepid water and then scalded out there were from 13,000 to 93,000 germs per cubic centimeter; and when the cans were washed in tepid water and subjected to live steam for 5 minutes the number was reduced to from 400 to 1,800 germs per cubic centimeter.

Remarks are also made on the influence of temperature of the milk on the growth of germs, showing the importance of cooling the milk quickly; and in conclusion a summary is given of precautionary measures to reduce the number of germs of milk to the minimum.

Milk sampling, C. L. Penny (*Delaware Sta. Rpt. 1896, pp. 132–157, figs. 2*).—This article contains a reprint of Bulletin 31 of the station (E. S. R., 8, p. 829) on the use of carbon bisulphid for preserving composite samples of milk for testing. In addition trials are reported with a large number of substances as preservatives which do not submerge the fat. These included salts of potash, ammonia, magnesium, sodium, barium, mercury, tin, silver, lead, iron, zinc, and a number of organic compounds. The best results were obtained with magnesia, magnesia mixture, mercuric chlorid, silver nitrate, sodium sulphite, potassium sulphocyanate, potassium permanganate. potassium bichromate, potassium carbonate, boric acid, formalin, alcohol, carbolic acid, and an alcoholic solution of camphor. Most of these preserved the fat in miscible condition.

"[The sample preserved with 1 per cent of potassium bichromate] after 3 months shows no sign of putrefaction or of curdling and is quite miscible. A less proportion of the preservative will doubtless be efficient. There is some danger of oxidation of the butter fat by means of the mixture of sulphuric acid and the bichromate. Where the latter salt is added to the milk by guess in unknown proportion a considerable [loss] in the fat found in the test may ensue. . . .

"The sample [treated with 10 per cent boric acid] after a week was free from putrid smell and was perfectly miscible. The reaction with sulphuric acid in the test bottles is like that of fresh milk. Five per cent failed to prevent curdling within 48 hours, the sample becoming quite putrid. . . .

"[With 0.3 to 0.7 per cent mercuric chlorid] the sample after several months was usually free from putrid smell and miscible. The antiseptic power of this reagent is well known to be very great. One-tenth per cent is insufficient to preserve milk a week, but 0.3 per cent is sufficient for a month or more. . . .

"[With 5 per cent of magnesia or magnesia mixture] the sample after 8 days had a putrid smell, with a translucent substratum. Notwithstanding, it was exceptionally miscible and the final results were among the most satisfactory. Doubtless much less than 5 per cent would be equally efficient. . . .

"[Formalin in proportion of 0.2 to 0.5 per cent] in point of minimum efficient quantity is the most powerful preservative tested. Even 0.2 per cent will keep a sample for weeks in excellent condition. It is questionable, however, whether this minute quantity, small as it is, is without influence on the Babcock test. The mixture of milk and acid has an unusual greenish appearance, and the fat column is hardly so clear and sharply defined as is the case with many other preservatives."

On the influence of food on the quality of butter, F. Friis (*37 de Ber. K. Vat Landbohöjskale Lab. Landökon Forsög, Copenhagen, 1897, pp. 112, 190*).—These experiments were conducted during 4 successive years, viz, 1892–'96, with special reference to studying the effect of the various rations fed on the quality of the butter produced. Two large Danish estates, well known for the high grade of butter produced, furnished the cows and other facilities for the experiments. The number of cows included in the different experiments on each farm was, as a rule, 60, separated into 3 lots of 20 each, care being taken in arranging the different lots to make them as uniform as possible as to breed, age, live weight, calving time, milk yield, richness of milk, etc. In all about 500 cows were included in the experiments. The effort was in all cases to make a first-class product of butter or the best product possible under the conditions, and the milk, cream, and butter of the different lots were always treated with this end in view. Only fresh cows were used, and only such of these as were found perfectly normal and healthy after a rigid examination. The milk of any cow showing symptoms of sickness during the progress of the experiment was kept by itself, so as not to contaminate the product of the other cows.

The plan and conduct of the experiments were similar to those of the cow-feeding experiments previously conducted by this station. During the preparatory period, lasting 20 to 30 days, the feed of the different lots on each farm was the same. The rations of all the lots but one was then gradually changed during a transition period of 10 days to that to be fed during the experiment proper, the one lot receiving the same feed throughout the experiment. Ten days after the experiment proper an after-feeding period followed, during which the feed of the different lots was changed back to that fed in the preparatory period. The experiments here reported included trials with the following feeds: Grains (barley and oats) against rape-seed cake (ordinary and pure, manufactured especially for the experiments), sunflower-seed cake, palm-nut cake, and rape seed; mangel-wurzels against turnips; and grains (barley and oats) against molasses feed (one-eighth palm-nut meal, three-eighths wheat bran, one-half beet molasses). Hay, roots, straw, bran, and oil cakes in varying amounts were fed in addition in all cases, according to the feeding practice on each farm.

The butter produced by the different lots was scored independently, when a couple of days old, by 3 expert judges, and again 14 days after the first scoring. In the tables published only comparative scores are given, viz, the number of points above or below that of the lot with which comparisons were made (normal). The total score for perfect butter was 15. The milk, butter, and butter fat produced and the feeding stuffs fed were analyzed. The average scoring of the butter above or below the normal (n) was as follows:

Results of feeding different rations for butter.

Rations fed.	First scoring.			Second scoring.		
	Preparatory period.	Experimental period.	Post-experimental period.	Preparatory period.	Experimental period.	Post-experimental period.
Grain *vs.* sunflower cake (4 experiments):						
Grain	n+0	n+0.5	n+0.7	n—2.2	n—1.0	n—2.5
Grain and sunflower-seed cake (1:1)	—0.2	+1.5	+0.9	—1.9	—1.1	—2.6
Sunflower-seed cake	+0	+1.7	+0.8	—1.7	—1.0	—3.0
Grain *vs.* rape-seed cake and rape seed (3 experiments):						
Grain	n+0.4	n+0	n+0	n—2.1	n—3.3	n—3.4
Grain and rape-seed cake (1:1)	+0.4	+0.2	+0	—2.3	—2.7	—3.9
Rape seed	+0.4	+0.5	—0.2	—2.1	—2.4	—4.0
Rape-seed cake *vs.* sunflower-seed cake (1 experiment):						
Common rape-seed cake	n+0	n+0.6	n+0.3	n—2.7	n—1.8	n—4.7
Pure rape-seed cake	+0	+1.3	+0.3	—2.3	—1.2	—4.3
Sunflower-seed cake	+0	+1.0	+1.0	—2.3	—1.8	—4.0
Grain *vs.* pure rape-seed cake and rape seed (2 experiments):						
Grain	n+0	n+0	n+0	n—1.8	n—3.6	n—3.4
Pure rape-seed cake	+0	+0.7	+0	—2.2	—2.8	—3.8
Rape seed	+0	+0.9	—0.2	—2.2	—2.7	—4.0

The sunflower-seed cake caused an appreciable improvement in the quality of the butter, but not in its keeping properties, while rape-seed cake and rape seed to a still greater degree improved both quality and keeping property. The value of the different kinds of concentrated feed was found to decrease in the following order with respect to effect on the fine quality of the butter: Rape seed, pure rape-seed cake, sunflower-seed cake, common rape-seed cake, cereals (barley and oats mixed). In these experiments 2 to 4 lbs. of grain were replaced by an equivalent amount of oil cake, or by one-tenth of rape seed, the balance of the rations fed being the same for all animals in the experiments. The butter from the grain-fed lots was firm, in cold weather even hard, while that from the lots fed oil cake was soft, with a tendency to be too soft. The feeding of oil cakes should therefore be comparatively light in spring when the weather turns warm.

The comparison of turnips and mangel-wurzels showed a slight difference in favor of the latter. There was practically no difference in the scorings of the butter produced on the grain-molasses feed experiments. The molasses feed showed a tendency to make a firm butter without in any way lowering its quality.

The cream from the lots fed oil cakes or rape seed was churned at about 2° C. lower temperature and in about 5 minutes shorter time than that from the grain-fed lots, the speed of the churn being the same for all churnings.

Yield and fat content of milk.—By replacing grain by an equivalent quantity of oil cakes there was invariably an appreciable increase in the yield of milk. The same was true when rape seed was substituted for a portion of the grain. The molasses feed gave no apparent increase in yield over the mixed grain.

As regards the influence of the food on the quality of the milk, previous results obtained in cow-feeding experiments at this station were corroborated, any changes occasionally observed being minute and not attributable to the feed. Chemical analyses of the milk and milk products showed that the increased yield of butter per 100 lbs. of milk (0.09 lb.) on sunflower-seed cake was due to the higher water content of the butter obtained on this feed. No differences were found in the butter yield or the composition of the butter from the lots fed grain, rape-seed cake, or rape seed.

Effect of pasteurization on quality of butter.—Comparable data were obtained in several experiments as to the effect of pasteurization on the quality of the butter, viz, in the grain *vs.* sunflower-seed cake experiments and in the mangel wurzels *vs.* turnips experiments. Each of these experiments includes 2 series, the former being conducted during 1892–'94 and the latter during 1893–'95. The results, in comparison with the normal (n), are summarized below:

Influence of pasteurization on quality of butter.

Rations fed.	First scoring.		Second scoring.	
	Cream not pasteurized.	Cream pasteurized.	Cream not pasteurized.	Cream pasteurized.
Grain *vs.* sunflower-seed cake:				
Grain	n+0	n+1.1	n—1.8	n—0.1
Grain and sunflower-seed cake (1:1)	+0.6	+2.2	—1.9	+0
Sunflower-seed cake	+1.0	+2.4	—1.8	—0.1
Mangel-wurzels *vs.* turnips:				
Mangel-wurzels	n+0	n+2.0	n—3.4	n—0.7
Mangel-wurzels and turnips *a*	(—0.8)	(+1.5)	(—4.3)	—1.5
Turnips	—1.6	+1.9	—4.2	—1.0

a One series only.

The improvement in the quality and the keeping properties of the butter produced from pasteurized cream was very marked in both experiments. The lots fed sunflower-seed cake produced butter of better quality and of better keeping qualities than that produced by the grain-fed lots, both when the cream was and was not pasteurized. The difference in favor of the mangel-wurzel disappeared, on the other hand, when pasteurization of the cream was practiced.

Effect of pasteurization on yield of butter.—The average percentage of fat in buttermilk from pasteurized cream was 0.359 per cent and from nonpasteurized cream 0.329 per cent (average of 71 single experiments).

The average water content of the worked butter from pasteurized cream was 13.90 per cent; from nonpasteurized cream 14.42 per cent (average of 66 single experiments). The yield of butter per 100 lbs. of milk, as found in the creameries, was but slightly different when the cream was pasteurized and when not pasteurized. As the average of 5 series of experiments conducted on 2 different estates, the yields of butter from pasteurized and from nonpasteurized cream were 3.524 and 3.532 lbs., respectively—a difference of only 0.08 lb. of butter per 1,000 lbs. of milk. The small deficit might be easily covered by working the pasteurized-cream butter slightly less.

Relation between the brine worked out and the decrease in water content of butter.—The following formula is given by the author as showing the relation of the amount of brine worked out and the water content of the butter: If S be the yield of butter per 100 lbs. of milk, P the water content of the butter, and Q that of the brine, and X the quantity of brine which must be worked out to decrease the water in the butter D per cent, then $X = \frac{S\,D}{Q - P + D}$. By substituting $Q = 80$ and $D = 1$, the formula will read $X = \frac{S}{81 - P}$. A table worked out on the basis of this formula is given in the bulletin.

Examination of butter fat.—Samples of butter fat produced on the different feed rations were examined by various analytical methods, the iodin number, saponification number, free fatty acids, volatile acids, and refractive index being determined in each case. Experiments showed that the amount of free acids in the butter is greatly decreased when the milk or the cream is heated previous to the churning; pasteurization of the milk reduces the free fatty acid content of the fat more than pasteurization of the cream. About half the acidity of fresh sour-cream butter is due to free fatty acids in the butter, and the other half to the acidity of the buttermilk remaining in the butter.

The differences in the composition of butter fat from pasteurized and from nonpasteurized cream are shown by the average data given in the following table:

Composition of butter from pasteurized and nonpasteurized cream.

	Free fatty acids.	Iodin number.	Saponification number.	Volatile fatty acids.	Refractive index.
	Cc.	*Gm.*	*Mgm.*	*Cc.*	
Butter from nonpasteurized cream	30.6	34.6	229.6	30.0	50.8
Butter from pasteurized cream	25.8	34.6	229.8	29.9	50.8

The pasteurization of the cream did not materially influence the iodin number, refractive index, saponification number, or contents of volatile acids in the butter fat, but the content of free fatty acids was appreciably decreased by pasteurization.—F. W. WOLL.

Experiments concerning the causes of abnormal butter, B. BÖGGILD and V. STEIN (*Tidsskr. Landökon, 16 (1897), pp. 163-183*).—Two experiments were conducted during the spring and the fall of 1896 with 24 and 16 cows, respectively, for the purpose of studying abnormal butter, especially the content of volatile fatty acids. The cows were partly new and partly old milkers. During the second and third periods of the second experiment, September, October, and November, 1896, 2 lots of cows were kept in the barn and 2 in the pasture, all cows receiving the same feed and treatment otherwise.

The experiments show that the drying off of strippers at the proper time is of great importance in preventing a low content of volatile acids; and that concentrated foods do not as a rule appreciably influence this, while potatoes may lower it considerably. It was found that the low volatile-acid content of butter fat during the fall months is due not only to the advanced stage of lactation of many cows at this time, but quite as much to the exposure of the cows to cold during these months.—F. W. WOLL.

Dairy stock, H. H. DEAN (*Ontario Agr. Col. and Expt. Farm Rpt. 1896, pp. 66-68*).—Remarks are made on the dairy herd and a record given for the year, arranged both by months and by individual cows. For the whole year the average cost of food was 5.2 cts. per gallon of milk, 11.6 cts. per pound of butter, and 5.2 cts. per pound of cheese.

Rations for dairy cows, H. GEORGE (*Jour. Agr. Prat., 1897, II, No. 33, pp. 279, 280*).—Several rations are suggested.

Miscellaneous dairy notes, H. H. DEAN (*Ontario Agr. Col. and Expt. Farm Rpt. 1896, pp. 68-70*).—This includes brief remarks on dairy conventions and farmers' institutes, testing rennet, trials in making square cheese, dairy tests at 2 fairs, and the needs of the dairy department.

On the effect of feeding fat to cows, H. H. WING (*New York Cornell Sta. Rpt. 1895, pp. 267-280*).—Reprint of Bulletin 92 of the station (E. S. R., 7, p. 236).

Means of distinguishing between raw and cooked milk, DUPOUY (*Répert. Pharm., 3. ser., 9 (1897), p. 206; abs. in Chem. Ztg., 21 (1897), No. 45, Repert., p. 132*).—Several reagents are mentioned. Among these are alcoholic tincture of guajak resin, guajakol, hydrochinon, pyrocatechin, α-naphthol, and p-phenylendiamin. With these reagents raw milk usually gives a coloration, believed to be due to an oxidizable ferment, similar to that occurring in many plants.

An apparatus for the rapid and accurate determination of the fat in milk, E. M. ARNDT (*Forsch. Ber. Lebensmtl., 4 (1897), No. 9, pp. 231, 232*).

A simple fat extractor, V. J. HALL (*Jour. Amer. Chem. Soc., 19 (1897), No. 7, p. 586, fig. 1*).—This is for use in milk analysis. It consists of a small, shallow dish of very light copper, drawn out to a neck below, which is fitted with two caps, one resembling a Gooch crucible. The method of making a determination is described.

Whey butter, H. H. WING (*New York Cornell Sta. Rpt. 1895, pp. 95-99*).—Reprint of Bulletin 85 of the station (E. S. R., 7, p. 69).

Tests of cream separators, H. H. WING (*New York Cornell Sta. Rpt. 1895, pp. 689-703*).—Reprint of Bulletin 105 of the station (E. S. R., 8, p. 87).

Sterilization and pasteurization of milk (*Amer. Kitchen Mag., 7 (1897), No. 5, p. 183*).—Popular directions for this purpose are given.

VETERINARY SCIENCE AND PRACTICE.

On the nature of Japanese farcy, an enzootic skin disease of the horses and cattle of Japan, H. TOKISHINGE (*Bul. Col. Agr. Imperial, Univ. of Japan, 31 (1897), No. 2, pp. 115–190, pls. 3*).—Farcy is noted as a very common disease in Japan, where it is popularly supposed that animals must pass through it some time during their lives and thereafter be immune. Animals that have had the disease are more valuable than those that have not.

In early times the disease was known only in the northern part of the country and there is reason to suppose it was introduced there probably from China or Korea, as the nature of the disease was wholly unknown until 1888, when several experiments were first conducted. Later the author discovered the pathogenic germ which he calls *Saccharomyces farciminosus* whence he concludes that the Japanese disease is mostly a saccharomycotic affection, though true farcy may occur. Some 33 cases examined and experimented with are more or less minutely described. Inoculation with saccharomycosis gave mostly negative results.

Summarizing the facts brought to light, the author classifies the skin disease known as farcy as saccharomycotic farcy, genuine farcy, and farcy of mixed infection—which in Japan are relatively important in the order given—pure glanders and farcy being rare.

Considering the etiology of the disease, the author states that the cause of *Saccharomyces farciminosus* is an oval, thick-walled, cellular body with a more or less homogenous content and having a diameter varying from 2.4 to 3.6 μ. The poles are usually pointed and at one of them 2 or 3 cells may sometimes be found joined together. There is suspended internally usually a coccus-like body which is strongly refractive and colorless or faintly yellow and has a rapid molecular movement. Generally it is found near one pole.

The organisms occur abundantly in the morbid tissues and products, either free or inclosed in pus corpuscles which may contain 10 to 30. Besides these bodies, granules resembling that in the germ have been found either simple or in the form of dipplococci.

The disease affects some organs more frequently than others, affecting the nose most frequently (84 per cent).

Facts from post-mortems and other sources indicate that the morbid appearances began generally in the cutis. Cases were observed in which infection arose through the hair follicles, sebaceous glands, etc., but, it is added, that for proper infection the predisposition of the animal plays an important rôle, and this seems to depend upon age, sex, color, etc.

The clinical and anatomical characteristics of the disease closely resemble glanders, but the 2 diseases may be distinguished, clinoanatomically especially, by the occurrence of saccharomyces chiefly in the skin, by characteristic cutaneous eruptions, by the pus being of a thick glutinous character or a thin fluid with cheesy floccules, and by the bilaterality of nasal infection; and, further, by inoculation, guinea pigs being generally subject to glanders, but not to saccharomycosis.

Mallein was experimented with, but its action was found too irregular for diagnostic purposes.

In cattle the course of disease, saccharomycotic farcy, is more chronic than in horses. The nodules are always in the subcutis, are smaller, and remain circumscribed for a long time. The formation of abscesses and ulcers has until now not been noted. The difference between the infection in the horse and that in cattle is attributed, with slight reservation, to the fact that the bovine lymphatic system is not so well developed as in the horse.

Relative to treatment, it is noted that cure is possible in the earlier stages by radical operations, such as extirpation of affected parts or their destruction with corrosiva. As the disease is miasmatic and extends over large areas, strict hygienic and sanitary measures are advised.

Several other diseases of horses are briefly described or mentioned.

Combating glanders by governmental regulations, HOEHNE (*Berlin tierarztl. Wochenschr., Beil. 3, pp. 1, 2; Beil. 4, pp. 1, 2; abs. in Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No. 22-23, p. 894*).

Bovine tuberculosis as a factor in the production of human tuberculosis, through the use of meat and milk (*Med. News, 1897, No. 4, pp. 102-105; abs. in Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No 22-23, p. 892.*).

Bovine tuberculosis, M. H. REYNOLDS (*Minnesota Sta. Rpt. 1896, pp. 343-417, 441-456, figs. 10.*)—Reprint of Bulletin 51 of the station (E. S. R., 9, p. 185).

Technical data of tuberculin experiments, M. H. REYNOLDS (*Minnesota Sta. Rpt. 1896, pp. 441-456*).—This contains an account of 11 autopsies, also of cover-glass preparations from the animals, and of the results of inocculation of rabbits and white rats.

Miscellaneous examinations: Animal bacteriology, F. D. CHESTER (*Delaware Sta. Rpt. 1896, pp. 80-82*).—An examination of the nasal sinus of a horse for glanders gave negative results, though a reaction had been obtained from an inoculation with mallein. Experiments were performed to learn whether a supposed *Aspergillus fumigatus* evolves sulpho-cyanids when grown on ferruginous media as stated by Raulin and Mortinotti.[1] Negative results were obtained. Inoculations of a rabbit with the spores of the supposed *A. fumigatus*, as also an inoculation with 1 per cent solution of sulpho-cyanid, gave negative results.

Anthrax vaccination versus tuberculosis, F. D. CHESTER (*Delaware Sta. Rpt. 1896, pp. 77-80*).—In the tests made rabbits and guineas pigs were employed. The experiments were embarrassed by the death of the animals as a result of the vaccination and of indeterminable causes. As a whole they fail to demonstrate that inoculation with anthrax will immunize an animal to tuberculosis, as maintained by Perroncito.

Diagnosis of anthrax cases in Delaware, F. D. CHESTER (*Delaware Sta. Rpt. 1896, pp. 74-77*).—Twenty-four cases are given, only 11 of which gave evidence of anthrax upon minute examination.

The preparation of anthrax vaccines, F. D. CHESTER (*Delaware Sta. Rpt. 1896, pp. 69-74*).—The author reports that he has demonstrated that the original virulence

[1] Centbl. Bakt. u. Par., 1. Abt., 19 (1895), pp. 142-148.

of vaccines once prepared may be preserved without great difficulty. Since the inoculation of a susceptible animal tends to increase the virulence of the virus, it is advised that one employ the least susceptible animal that the same virus is capable of killing, and for an example he suggests that a No. 2 virus should be passed through a guinea pig rather than a mouse. In support of his conclusions, the author gives several tables showing the history of his viruses, all of which are continued from the Annual Report for the year 1895.

Combating anthrax in Delaware, A. T. NEALE (*Delaware Sta. Rpt. 1896, pp. 7–35*).—This is a reprint of Bulletin 32 of the station (E. S. R., 9, p. 92) with the addition of several paragraphs relating to culture tests, 4 tabular records of tests, and cultures, and a table, closing the vaccination experiments to July, 1896, of 7 mice and 4 guinea pigs, tested with vaccine No. 1. All the mice died on the second day and all the guinea pigs survived. With the mice the results were the same in the case of vaccine No. 2. Of the guinea pigs 60 per cent died, while all the rabbits tested survived. With vaccine No. 3, all the guinea pigs died and all the rabbits survived.

Nomenclature for infectious diseases, W. H. THOMPSON (*Trans. New York Med. Acad., 2. ser., 11 (1894), pp. 302–320*).

Recent investigations on the hepatic nodules and observations on the pulmonary nodules of the horse, B. GALLI-VALERIO (*Il Moderno Zooiatro, vol. 5, No. 9; abs. in Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No. 22–23, pp. 886, 887*).—It was found that in the liver of the horse the emboli arising from distomid eggs in the smaller gall passages cause a nodular formation in which as many as 20 eggs of *Distomum lenceolatum* may be found. Calcareous bodies due to an unkown nematode larva were also found in the lungs. These bodies might give rise falsely to a diagnosis of glanders.

Animal and vegetable parasites associated with the production of neoplasma in cattle and sheep, A. PARK (*Trans. and Proc. New Zealand Inst., 28 (1895), pp. 451–454; abs. in Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No. 22–23, p. 895*).

Intestinal parasites in China (*Rev. Sci. (Paris), 4. ser., 8 (1897), No. 15, p. 172*).—It is noted that certain ascarid parasites are so frequent at Pekin that 95 per cent of the children are attacked. The same parasites are very frequently found in adults. They enter the system with drinking water and leguminous plants, which are frequently eaten raw by the natives. Europeans who boil or filter their drinking water and cook their food are seldom attacked. Tapeworms are not at all common among the natives, since little meat is consumed.

STATISTICS—MISCELLANEOUS.

Agricultural returns for Great Britain, 1896 (*London: Eyre & Spottiswoode, 1896, pp. 283, maps 2*).—This report embraces 124 tables showing the acreage and production of crops, prices of grains, and number of live stock for Great Britain, and giving general agricultural statistics for the United Kingdom, British possessions, and foreign countries.

The number, size, distribution, and character of agricultural holdings in Great Britain have been made the subject of special inquiry during the past year. From the figures given, it is shown that 51.48 per cent, or more than one-half of all the holdings of Great Britain exceeding 1 acre in extent, were of the type of small farms not exceeding 20 acres in extent. Farms above 20 and not exceeding 50 acres in extent accounted for about 16.5 per cent of the holdings and farms between 50 and 300 acres accounted for about 28.5 per cent, while "the number of large farms with more than 300 acres of cultivated land form very little over 3.5 per cent of the holdings."

The total cultivated lands of Great Britain in 1896 was 32,577,513 acres, the number of holdings 520,106, and the average size of the holdings nearly 63 acres. Only 11.7 per cent of these holdings were owned by the occupants, 84.5 per cent being rented and 3.8 per cent being partly rented and partly owned. More than 51 per cent of the total cultivated area is in the form of permanent pasture and of the small holdings not exceeding 5 acres in extent nearly 68 per cent is in permanent pasture.

The yield and acreage of the various farm crops are commented upon at length and compared with similar data for previous years. The average yield per acre in 1896 of a number of farm crops is as follows: Wheat, 33.68 bu.; barley, 33.63 bu.; oats, 36.83 bu.; beans, 25.66 bu.; potatoes, 6.32 tons; hay from clover, sainfoin, and grasses under rotation, 24.16 cwt.; hay from permanent pastures, 17.51 cwt. Tables are given showing the average local prices for 1896 of wheat, barley, and corn in 196 appointed markets and serial tables extend this information as to comparative prices for England and Wales back to 1771.

Eighth Annual Report of Arizona Station, 1897 (*Arizona Sta. Bul. 25, pp. 9*).—Contains a financial report for the fiscal year ending June 30, 1897; list of bulletins published by the station; and brief reports by the director, botanist, and entomologist, and chemist on the work covering the period from January 1 to June 30, 1897. A list of nearly 100 varieties of seeds of grasses and forage plants sown at the station is included in the director's report.

Report of treasurer of Delaware Station, 1896 (*Delaware Sta. Rpt. 1896, pp. 4, 5*).—For the fiscal year ending June 30, 1896.

Report of Idaho Station, 1896 (*Annual Rpt. Pres. Bd. Regents Univ. Idaho, 1896, pp. 42–45, 58–72*).—This includes the financial reports of the treasurer for the fiscal years ending June 30, 1895 and 1896; an account of the actions of the board of regents in curtailing the work and expenditures of the substations; a record of the acceptance by the board of deeds for 83 acres of land presented to the station by the citizens of Moscow and Latah counties for experimental purposes; and a reprint of Office of Experiment Stations Circular 29.

Tenth Annual Report of Maryland Station, 1897 (*Maryland Sta. Rpt. 1897, pp. 163–167*).—A brief report by the director on the station staff and publications, and outlining the general experimental work for the 6 months ending June 30, 1897; and a financial statement for the fiscal year ending June 30, 1897.

Annual Report of Minnesota Station for 1896 (*Minnesota Sta. Rpt. 1896, pp. 462*).—This embraces a financial statement showing the receipts and disbursements of the Hatch fund for the fiscal year ending June 30, 1897, and further statements showing the receipts and disbursements for station funds other than Hatch for the 18 months ending June 30, 1897; a report by the director giving an outline of the work of the year and including records and data relative to the establishment of a substation at Grand Rapids, Itasca County; and reprints of Bulletins 47–52 of the station. Some technical data on tuberculin experiments and the meteorological observations included in these pages are noted elsewhere.

Seventh Annual Report of New Mexico Station, 1896 (*New Mexico Sta. Rpt. 1896, pp. 31*).—Brief reports by the director, heads of departments, and superintendents of the Las Vegas and San Juan substations on the general work of the year, including a subject list of papers published by the entomologist, and a financial report for the fiscal year ending June 30, 1896.

Eighth Annual Report of New York Cornell Station, 1895 (*New York Cornell Sta. Rpt. 1895, pp. 721*).—Brief reports by the director and heads of departments on the general work of the year, including detailed statements of the receipts and expenditures for the fiscal year ending June 30, 1895, together with an appendix of 22 station bulletins and a spray calendar issued during the year ended December 31, 1895.

Crop report for September, 1897, J. HYDE (*U. S. Dept. Agr., Division of Statistics Rpt. 152, n. ser., pp. 4*).—The usual notes on crop conditions, with a discussion of the wheat situation and tabulated data showing the average condition of crops September 1, 1897.

Crop report for October, 1897, J. HYDE (*U. S. Dept. Agr., Division of Statistics Rpt. 153, n. ser., pp. 4*).—The crop conditions for the month are discussed and a review given of the foreign crop situation as reported by the Hungarian and the French ministers of agriculture.

Report on crops, live stock, etc., in Manitoba (*Manitoba Dept. Agr. and Immigration Bul. 53, pp. 19*).—Statistics relative to the "condition of crops and live stock, probable yield per acre of the various kinds of grains, the quantities of land broken for the first time this season;" rainfall of the different districts for the 4 months ending with July, and general remarks on crop conditions quoted from correspondents.

Crops and live stock in Ontario (*Ontario Bureau Industries Bul. 62, pp. 16*).—August crop report, with statistics of the live stock on Ontario farms on hand July 1, 1895–'96–'97, and remarks by crop correspondents.

Agricultural statistics of the dominion of the Hungarian Crown (*A magyar korona országainak mezögazdasagi statisztikaja. Vol. I. Compiled by the Hungarian Statistical Bureau. Budapest, 1897, pp. X, 226, 765*).

Report of the farm superintendent, W. RENNIE (*Ontario Agr. Col. and Expt. Farm Rpt. 1896, pp. 203–210*).—A summary of the improvements made, the crops grown, the methods of cultivation, the feeding of live stock, the practical instruction given to students, and the annual sale of surplus stock.

Abstract from the report of the experimentalist, C. A. ZAVITZ (*Ontario Agr. Col. and Expt. Farm Rpt. 1896, pp. 117–122*).—Prefatory notes to the complete report of the work done during the year concerning the equipment and the work of the station, the reports and bulletins issued, the correspondence carried on, and the methods of conducting the grain experiments. Abstracts of the experiments appear elsewhere.

Guide to the Central Experimental Farm [Canada] for 1897, with plan showing the location of the buildings, with particulars of the arrangement of the different crops and groups of experimental plats for the season of 1897, W. SAUNDERS (*Ottawa: Government Printing Bureau, 1897, pp. 14, map 1*).

Farmers' institutes in Pennsylvania (*Pennsylvania Dept. Agr. Bul. 26, pp. 74*).—Suggestions on methods of conducting farmers' institutes, with a schedule of the institutes to be held in the State during the season of 1897–'98, a list of the lectures, with their subjects and appointments, and a list of the dates and places where institutes were held last season.

Second report of the committee on the methods of teaching agriculture (*U. S. Dept. Agr., Office of Experiment Stations Circ. 37, pp. 4*).—This is a report of progress presented by the committee to the Association of American Agricultural Colleges and Experiment Stations at the convention held in Minneapolis, Minnesota, July 13–15, 1897, suggesting additional subjects to be included in the four years' course in agriculture leading to the degree of Bachelor of Science, and the number of hours to be devoted to each; with a synopsis of the course suggested in agricultural work and statements showing in a general way the equipment required in connection with this course.

NOTES.

ARIZONA UNIVERSITY AND STATION.—M. M. Parker, of the Troop Institute, Los Angeles, California, has been elected president of the University *vice* Howard Billman, resigned.

NEW HAMPSHIRE COLLEGE AND STATION.—Hon. Frank Jones, of Portsmouth, has been elected president of the board of control. C. H. Waterhouse has been appointed superintendent of the creamery and Elwin H. Forristall superintendent of the farm; and Leigh Hunt has resigned his position as assistant agriculturist and horticulturist of the station. The board of control at its last quarterly meeting voted to discontinue the farm and creamery as a part of the experiment station. Field experiments are to be confined to small areas and feeding and dairying experiments arranged in cooperation with the college.

NORTH DAKOTA COLLEGE.—A new drill hall and gymnasium, 40 by 94 ft., with suitable gun room and officers' quarters is nearing completion. A fifty horse-power boiler has been added to the heating plant, and steam is now furnished the mechanical building for power and heating purposes. A large coal shed has also been added to the heating plant, which will afford storage room for a sufficient quantity of coal to tide over any snow blockade liable to occur. The new chemical laboratory has been completed and fully equipped.

SOUTH CAROLINA COLLEGE AND STATION.—Ernest Walker has been appointed entomologist and assistant horticulturist of the station. A poultry division has been added to the department of agriculture of the college and station.

WASHINGTON COLLEGE.—The 5-story brick dormitory was burned November 22, 1897. The building was occupied by 90 students, all of whom have been provided quarters elsewhere.

WISCONSIN UNIVERSITY.—W. L. Carlyle, a graduate of the Ontario Agricultural College and for some years past an instructor in the Minnesota farmers' institutes, has been appointed professor of animal husbandry in the University to succeed John A. Craig, resigned.

PERSONAL MENTION.—Dr. Schmidt-Dumont, assistant in the forestry experiment station at Tharand, Germany, has been appointed director of the agricultural chemical experiment station to be established at Pretoria, Transvaal.

Dr. K. Bieler, formerly assistant in the agricultural-chemical experiment station at Halle, Germany, will succeed Prof. O. Loew as professor of agricultural chemistry in the University of Tokio.

Dr. Albert Schneider has become professor of botany in Northwestern University, Chicago, Illinois.

Dr. A. Zahlbruckner has become associated with the botanical section of the Royal museums of Vienna.

Prof. G. Thoms, director of the agricultural experiment station, professor of agricultural chemistry, and dean of the agricultural department of the Polytechnicum at Riga, Russia, celebrated the twenty-fifth anniversary of his connection with the experiment station September 1, 1897. Several newspaper accounts of the life and work of Professor Thoms, published on that occasion, have been received.

EXPERIMENT STATION RECORD.

VOL. IX. NO. 6.

The importance of careful studies of the influence of meteorological and climatic conditions on the growth of plants has frequently been urged in the Record. Many of the stations have from their organization carried on series of the usual observations on the temperature, rainfall, etc., but these observations, as a rule, have either had no definite aim in view, or have had some other object than the study of these factors as related to the development of crops. They have also rarely been made in direct connection with the growing plant in the experiment field under circumstances insuring an accurate record of the conditions which actually prevail there. They have consequently been of little or no utility in interpreting the phenomena of plant growth.

Phenological observations, which may be considered a step in advance of the observations just mentioned when systematically and continuously carried out, have received little attention from the agricultural institutions of the United States. Ihne's bibliography,[1] however, shows that the literature of such studies in other parts of the world is by no means insignificant, and yet even with the aid of the best of these observations little progress has actually been made in determining what influences a given meteorological or climatic condition or set of conditions will exert on the final product of a plant or what are the conditions which will give the maximum and optimum of a given crop.[2]

No attempt has been made in the past by the stations to carry out consistently planned investigations along the lines suggested through the long periods of time necessary to arrive at satisfactory conclusions. This seems somewhat remarkable, because, aside from the intrinsic importance of the knowledge to be thus secured, this work, as Professor Harrington has said, "affords a field for the display of skill and talent which is not surpassed in any other branch of science and the surroundings of the experiment station and agricultural college are very favorable for carrying it on."

There are many lines of such work which promise abundant reward to the patient and persistent investigator. Professor Harrington has enumerated among others "such problems as the distribution of temperatures within such heights in the air and depths in the soil as are occupied by animal and plant life and the changes of temperature with

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[1] Phänologische Beobachtungen aus den Jahren 1879-'82.

[2] For suggestions regarding phenological observations, see Bailey: U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 24 (1896), pp. 328-331 (E. S. R., 8, p. 672).

the hour of day, with the season, with the weather, and with the topography; the problems of air drainage; the occurrence of frosts and protection from them; the distribution of moisture; the problems of condensation and evaporation of water in the air; the solar and terrestrial radiations and the disposition of them; the action of the meteorological elements on organic life and the reactions of life on them; the actions and reactions of weather, climate, and soil; the precipitation of the moisture of the air and the disposition of it." Some of these problems have already been attacked by the stations, but, as stated above, others, especially those bearing upon the relations between the meteorological elements and the development of the plant, still demand investigation.

A system of observations which seems to promise definite results in determining the bearing of some of the more important meteorological factors on plant growth has been outlined by this Office as follows:

Plan for field studies on the relations of climate and crops.

[Crop—Corn.]

- FIELD:
  - 12 tenth-acre plats.
  - Elevation (absolute and comparative).
  - Slope.
  - Exposure.
  - Proximity to woodland and water.

(Field must be kept clear of all vegetation except the corn, the year round.)

- AIR:
  - Observations in field:
    - Temperature 3 in., 2 ft., 4 ft., 6 ft. above surface.
    - Humidity.
    - Precipitation.
  - Observations near field (Self registering instruments):
    - Sunshine.
    - Wind.
    - Rainfall.

- SOIL:
  - Physical and chemical properties (observed yearly about planting time).
  - Temperature—tridaily at surface and 3 depths.
  - Moisture—weekly or daily.
  - Manuring—same for 9 plats; 3 plats unmanured (amount of fertilizer sufficient to maintain fertility).
  - Cultivation—same method each year.

- PLANT:
  - Variety—standard (seed should be average of whole crops each year).
  - History of seed.
  - Germination test.
  - Time of planting (3 plantings at weekly intervals).
  - Depth of planting (same each season).
  - Distance of planting.
  - Sprouting (first and at regular intervals daily to determine average).
  - Number of missing hills.
  - Measurement of plant at fixed intervals (appearance of nodes).
  - First 10 per cent and 50 per cent:
    - Date of tasseling.
    - Date of appearance of ear.
    - Date of milk stage.
    - Date of glazing.
  - Date of harvest.
  - Product—yield (total and parts) and quality (commercial and chemical) and relation of parts.

MISCELLANEOUS: Damages from insects, diseases, frosts, storms, etc.

(The 12 one-tenth acre plats occupy only $1\frac{1}{5}$ acres, and are surrounded by a 7-foot protecting margin which is planted like the plats. The crop on this margin of course is harvested separately, and enters no further into the experiment. It is designed that there shall be six $3\frac{1}{2}$-foot rows on each plat, the plats being 21 feet wide).

This plan limits the investigations to one crop—corn—and a definite set of observations, but contemplates duplicating the observations in a number of localities. It is offered simply as a suggestion of the direction such studies might profitably take. Similar studies might be planned for other farm crops.

Such field observations have been greatly simplified by Professor Whitney's recent invention of electrical apparatus for the measurement of temperature and moisture in soils in place.

The observations in the field might well be checked by studies in the greenhouse or "climatological laboratory" suggested by Professor Abbe, where the various conditions are under more or less complete control.

The results obtained in investigations of this character will have an important bearing upon the question of the life zones of agricultural plants, which is receiving considerable attention at present. The attempt has been made to map the life zones of agricultural plants on the basis of the sums of effective temperature (above 42 or 43° F.); but, as Sir Henry Gilbert has so forcibly maintained, we can make no safe practical application of the sums of effective temperature without taking into consideration the modifying influences of other meteorological factors, and this necessitates careful and detailed observations of all of these factors in their adaptation to the character and phases of development of the plant itself. This measurement of the relation between the meteorological elements in terms of plant development is defined by Professor Whitney as climatology in its strict sense. Climatology, therefore, "is not a simple summation, but a complicated expression involving the general relation of certain functions of meteorological elements the values of which we do not as yet understand."[1]

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[1] Science, n. ser., 7 (1898), No. 161, pp. 113–115.

THE METHODS OF DETERMINING THE DIGESTIBILITY OF FEEDING STUFFS.

Dr. O. Kellner,

Director of the Agricultural Experiment Station at Möckern, Germany.

The percentage of digestible constituents in feeding stuffs is calculated from the difference between the constituents of the food and the feces, it being assumed that the feces consist principally of the residue of the food. In determining the digestible nutrients of a feeding stuff it is necessary to determine both the amount and the composition of the food and the feces. In regard to the latter, it is essential that the feces represent the feeding stuff under experiment, not only qualitatively but also quantitatively. Accordingly in the case of herbivorous animals, considering their extensive and complicated digestive tract, it is necessary to insure the complete removal of all residues in the digestive apparatus from the previous feeding before the feces for the investigation are quantitatively collected. Furthermore, as the voiding of feces is very irregular from day to day and the amount may differ by more than 30 per cent, the feces must be collected without loss for a considerable time.

DURATION OF THE EXPERIMENT.

A digestion experiment is divided into a preliminary period, in which the residues from previous feeding are excreted from the body; and a feeding period proper, during which the feces must be quantitatively collected. On the basis of numerous investigations it is safe to conclude that the preparatory feeding should last at least 5 days in the case of ruminants, and 3 or 4 days in the case of horses and pigs. It is safer, however, to continue the preparatory feeding for 8 days with ruminants and for 6 days with horses and pigs. Under certain exceptional conditions, when a very easily digestible feeding stuff is to be tested and foods which are difficult to digest have been previously fed, the preparatory period should be even longer. In such cases the microscope may be used with advantage in examining the feces for traces of the previous food. The main period, in which the feces are quantitatively collected, should last at least 8 to 10 days with ruminants and 6 days with other animals.

SAMPLING THE FEEDING STUFFS.

Throughout the experiment, including the preparatory period, there should be no variation in the composition of the rations. In the case of concentrated feeding stuffs this presents no difficulty. Previous to the beginning of the experiment the concentrated feeding stuffs should be thoroughly mixed, and the daily rations for each animal weighed out in separate vessels or in paper bags, an average sample being taken for analysis; or the rations may be weighed out each day, a subsample of constant amount (200 gm.) being taken each day, and these subsamples kept in a bottle for analysis.

With roots and tubers the matter is somewhat more difficult. These vary widely in composition, and undergo changes from partially drying and also as a result of respiration. In case of these it is decidedly preferable to take samples daily after the roots have been cut up. The same applies to green fodders, silage, distillery refuse (slump), and similar feeding stuffs.

The samples taken daily are immediately dried at a low temperature, and mixed later. If the differences in the feeding stuff can not be equalized by mixing, it is advisable to continue the experiment for a longer time than stated above.

In the case of coarse fodders, as hay and straw, the method of procedure is as follows: If the experiments are to be made with sheep, or only a single experiment with steers, a sufficient quantity of the fodder for the trial is cut fine, mixed thoroughly on a tight floor, spread out in a thin even layer (2 to 3 in. thick), and small samples taken from about 20 different parts of the layer. These samples are mixed, spread out in a circle, and segments of this circle taken from different parts, which when united make several kilograms. This serves as the sample for analysis. Samples which are taken by hand from a large heap of coarse fodder do not represent the average of the material. The ration for each day of the experiment is weighed out previous to the experiment in tightly woven bags, samples being taken for the determination of water.

If, on the other hand, it is the intention to use a coarse fodder in a long series of experiments with steers or horses, the separate wagon loads as they are delivered are spread out in layers in the mow, small samples being taken of each portion or forkful, so that from 10,000 lbs. of hay 300 to 500 lbs. of samples would be taken. These samples are cut in a fodder cutter, and sampled as described above. In this way it is possible to determine the average composition of coarse fodder, as the following illustration will show: In August, 1894, 12,500 lbs. of hay was delivered at the agricultural experiment station at Möckern, the average samples of which, taken as described above, contained 1.6 per cent of nitrogen and 46.16 per cent of carbon in dry matter, and yielded 4,430 calories of heat per gram when burned in the calorimeter. Thirteen months later, when about 2 tons of the hay remained, another sample was taken which was found to contain 1.583 per cent of nitrogen and 46.19 per cent of carbon, and to yield 4,415 calories of heat.

COLLECTION OF THE FECES.

The quantitative collection of the feces is effected in different ways in the case of different kinds of animals. In experiments with steers the stall (fig. 1) is arranged with a manger which may be moved forward or backward to suit the size of the animal, and raised or lowered. The floor of the stall is of asphalt, inclining slightly toward the center, with a hole at this point through which passes the tube from the urine funnel.

At the rear is a drop (A) 4 ft. long and 20 in. wide; and an upright partition extends the entire length of each side of the stall. In one corner of the drop is a removable covered copper box (B), about 16 in. square by the same depth, into which the dung is scraped as soon as voided with a wooden shovel and a broom. The length of the stall is

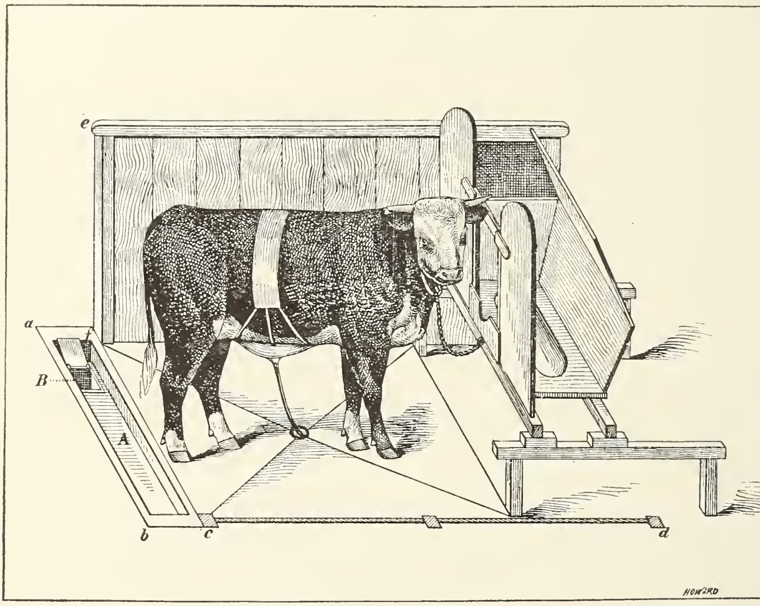

Fig. 1.—Stall for digestion experiments with steers.

adjusted so that when the manger is closed the animal stands with its hind feet just on the edge of the drop. The manger is closed on the side next to the animal except during feeding time, so that the animal can not stand too far forward and let the dung fall upon the floor of the stall instead of in the drop.

To prevent the urine from mixing with the feces, the animal wears a urine funnel made of heavy rubber covered with strong leather. The tube of this funnel passes through a hole in the floor and empties into a bottle below.

Even with great care, small portions of dung adhere to the drop and rear part of the stall and are not removed by the broom or wooden shovel. In order to estimate the amount of this, the stall is washed several hours previous to the beginning of the experiment, and again after the experiment. The wash water from the last operation is carefully evaporated, the residue weighed, the dry matter in it determined, and this added to the dry matter of the feces previously collected. The animals soon get accustomed to having no straw on the floor of the stall if it is taken away gradually.

In experiments with horses the stall and manger can be arranged the same as for steers, except that the stall should of course be made larger. The collection of the feces is simpler than with steers. The drop at the rear of the stall is not necessary. Instead, a rubber apron with a light, bent strip of wood at the top is attached to the animal under the tail. The lower end of this apron is kept flat by a stick sewed into it, and is suspended over a tin box 14 to 16 in. wide by means of cords

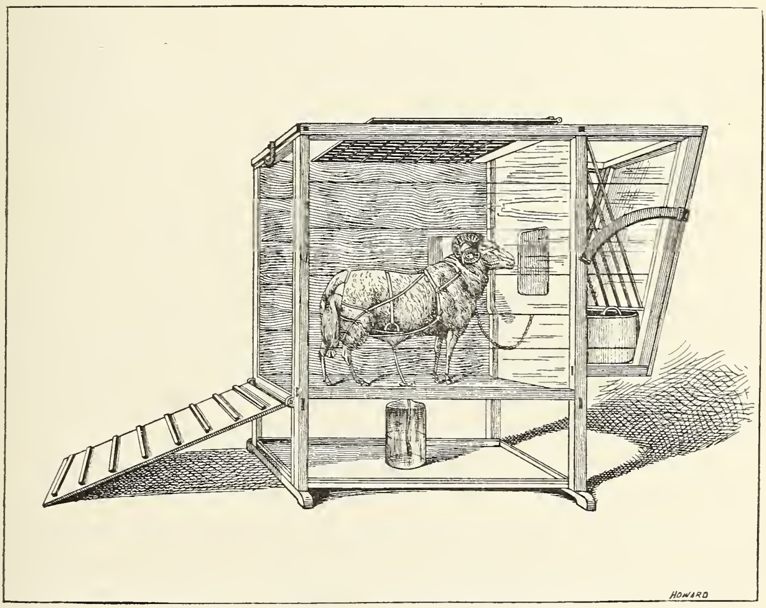

FIG. 2.—Stall for digestion experiments with sheep.

passing through pulleys overhead with small bags of sand attached as counterpoise. The droppings roll down the apron into the box and are collected from time to time in a tared copper box, provided with a cover to prevent drying out.

The collection of feces is even simpler in the case of sheep, to which rubber bags can be so attached as to collect the droppings without loss. The sheep are confined in box-like stalls (fig. 2), 40 in. long, $22\frac{1}{2}$ in. wide, and 40 in. deep, the whole being raised on legs about 20 in. from the floor. At the front end of the stall is a removable metal manger, which fits closely to the end of the stall and just below the opening in front of the animal. This opening can be closed by a sliding door.

To prevent the animal from gnawing the stall, the front half and the sliding door are covered with tin. The rear end of the box is hinged so it can be let down upon the floor, and has cleats nailed across it at right angles to facilitate placing the animal in the stall or removing it. The stall has an opening on one side, closed by a sliding door, through which the drinking water can be introduced in a square vessel. A bottle is placed underneath the stall into which the urine tube empties.

In experiments with pigs the harness for collecting the feces and urine has often been omitted, as pigs are in the habit of depositing the dung regularly in a particular place in the pen, and may readily be made to deposit it in a receptacle provided for the purpose. But if a sufficiently narrow stall of slats is used the feces bag and urine funnel can be used on pigs, and this is considered preferable.[1]

SAMPLING THE FECES.

The feces voided during a period of 24 hours are first weighed, pulverized, and thoroughly mixed. Aliquots of about 100 gm. are weighed out in flat dishes, dried at 60° C., and then kept at the temperature of the room until they are practically constant in weight (air dry). The moisture is determined in these air-dry samples, and for this purpose the samples from several days may be mixed.

THE KIND OF ANIMALS FOR EXPERIMENT.

The kind of animals to be used for experimental purposes will depend principally upon the object of the experiment. There is little doubt that the various kinds of farm animals do not differ very much in their ability to digest concentrated feeding stuffs, and the digestion coefficients obtained for concentrated feeding stuffs with sheep may be used in calculating practical rations for cattle and even for horses.

But with coarse fodders the case is different. It is known definitely that coarse fodders are more thoroughly digested in the complicated stomach and intestines of ruminants than in the simpler digestive apparatus of horses and swine. There is believed to be no considerable difference in this respect between the different kinds of ruminants, especially between cattle and sheep. The average digestion coefficients obtained in experiments with sheep agree approximately with those obtained with steers for coarse fodders of the same kind but of different origin. Hence, it appears to be immaterial from the standpoint of practice whether the coefficients of digestibility obtained with sheep or with steers are used in calculating rations, especially as in practice the content of crude nutrients in coarse fodders is only estimated approximately. Under these conditions, as the experiments with sheep are simpler, more convenient, and cheaper, most experiment stations have chosen sheep very largely for such experiments.

The digestibility with different kinds of ruminants is not entirely uniform, as is shown by some parallel experiments made incidentally

[1] A description of such a stall is given in Jour. Landw., 33 (1885), p. 154.

by the writer at the agricultural experiment station at Möckern.[1] In one series of experiments medium quality meadow hay, and in another oat straw were each fed to steers and sheep. The composition and digestibility of the feeding stuffs are shown in the following table:

Comparative digestibility by steers and sheep of hay and straw.

	Composition of dry matter.	Digestion coefficients.		Digestible nutrients in dry matter.	
		Steers.	Sheep.	Steers.	Sheep.
Meadow hay:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Dry matter	100.00	64.9	62.4		
Organic matter	92.94	67.1	64.6	62.4	60.0
Crude protein	10.00	60.6	57.0	6.1	5.7
Nitrogen-free extract	53.13	70.3	68.5	37.3	36.3
Crude fat	2.58	61.0	56.7	1.6	1.5
Crude fiber	27.23	63.8	60.5	17.4	16.5
Oat straw:					
Dry matter	100.00	57.2	47.1		
Organic matter	93.22	58.1	47.7	54.2	44.5
Crude protein	4.46	31.7	18.5	1.4	0.8
Nitrogen-free extract	49.13	57.7	49.4	28.3	24.3
Crude fat	2.25	42.9	50.4	1.0	1.1
Crude fiber	37.48	62.6	48.7	23.5	18.3

It appears from the above that there are differences between these two classes of animals, which are to the advantage of the steers. The sheep digested from the meadow hay slightly less and from the oat straw about 10 per cent less dry matter than the steers.

Without entering into a discussion of the causes of the lower digestibility or resorption of the straw by sheep, it may be mentioned that the difference observed for this feeding stuff is sufficient to suggest a further investigation of this question of the relative digestibility by steers and sheep.

EFFECT OF THE DIGESTIVE FLUIDS.

As already mentioned, the digestibility of a feeding stuff is calculated from the difference between the nutrients in the food eaten and in the feces excreted. In this it is assumed that the feces consist almost entirely of residues of the food and contain only small amounts of substances derived from the body. As a matter of fact, the constituents of the digestive fluids are for the most part resorbed again in the intestines, as was shown by the investigations of Wildt with sheep. Small quantities of these secretions, as mucin, bile, etc., pass off in the feces, and under some circumstances may have an appreciable effect on the coefficients of digestibility. If the amount of digestible nitrogenous substance calculated from the difference between the nitrogen in the food and in the feces be compared with that estimated by artificial digestion (treatment of the feeding stuff with acid pepsin solution) it will be found that the latter method regularly gives the higher result. This apparent increase by pepsin digestion amounts, according to the

[1] Not yet published.

writer's investigations made some 16 years ago, to from 0.3 to 0.5 gm. and averages 0.4 gm. of nitrogen per 100 gm. of digestible dry matter. Approximately the same figures were obtained later by T. Pfeiffer and E. von Wolff; and a calculation of 20 experiments made by G. Kühn with steers, in which a method of artificial digestion worked out by himself was used, shows that by this method of artificial digestion from 0.36 to 0.58 gm. (average 0.46 gm.) more nitrogen was dissolved (digested) than was indicated by the difference between the nitrogen in the food and in the feces.

The explanation of this discrepancy between the results of natural and artificial digestion is near at hand. Since, on the one hand, the digestion of the protein of a given feeding stuff is very constant for the same class of animals, it is fair to assume that there is a quite marked distinction between the digested and undigested part of the feeding stuff. On the other hand, mucin and biliary products can be recognized in the feces. It seems very probable, therefore, that the excess of nitrogen in the feces is to be ascribed to the nitrogenous digestive fluids. Experiments made by T. Pfeiffer with swine have confirmed this opinion. He fed artificial mixtures of starch, sugar, oil, salts, paper fiber, and pure conglutin to pigs, and found 0.426, 0.364, 0.384, and 0.401 gm. (average 0.394 gm.) of nitrogen in the form of metabolism products per 100 gm. of digested dry matter, *i. e.*, nearly the same amount as found by the writer with sheep.

It can not be expected that every individual experiment will show exactly the above amount (0.4 gm.), for there are many sources of error in this indirect determination. Principal among these are inaccuracies in fixing the limits of the feces and the small errors in the determination of nitrogen in the food and feces; a difference of ± 0.03 per cent of nitrogen here will materially affect the results. It is strange, therefore, that some authors, on the basis of experiments which agree in the average with the above value but show variations of 0.2 to 0.3 gm. of nitrogen, refuse to recognize a regular relation between the digested dry matter and the nitrogen of the feces derived from the digestive secretions. Where a method of investigation contains unavoidable errors in both directions, only the average of a large number of investigations can be used. The data obtained by such means have as yet not disputed the rule worked out by the writer that for each 100 gm. of digested dry matter the feces contain 0.4 gm. of nitrogen from metabolism products. This rule, as we shall see presently, is of importance in judging of the so-called "depression in digestibility" of crude protein, believed to have been observed when substances poor in nitrogen or entirely free from it were added to the ration.

It would be very interesting in this connection if in all digestion experiments with animals the feeding stuffs were also treated by G. Kühn's method of artificial digestion. This method, which is simpler and more accurate than Stutzer's pepsin-pancreas method, prescribes that 2 gm.

of the air-dry, finely-ground feeding stuff be digested at body temperature with 500 cc. of acid pepsin solution for 48 hours, increasing the hydrochloric acid every 12 hours so that at the end of 36 hours it shall be equivalent to 1 per cent.[1]

AMOUNT OF FOOD.

As to the effect of the amount of food on its digestibility in the alimentary canal, it is safe to conclude from the experiments of Henneberg and E. von Wolff in feeding rations of various amounts of meadow hay, alfalfa hay, and clover hay to steers and sheep that the amount of food may vary within quite wide limits without appreciably affecting the digestibility.

FODDER MIXTURES.

The case is different with regard to the fodder mixture, *i. e.*, the proportion of the separate nutrients in the ration. A large number of feeding experiments have shown that the digestibility varies with the percentage of protein in the ration. According to experiments by E. Schulze and M. Maercker with maize gluten, Stohmann with lupines, and the writer with fish meal, lupines, and soy beans, the addition to the ration of these feeding stuffs rich in protein effects a somewhat better digestibility of the crude fiber and nitrogen-free extract of the rest of the ration. In fact, in some experiments nonalbuminoid protein, as asparagin, has shown such an effect.

On the other hand, an increase of the carbohydrates in the ration is accompanied by the reverse effect; the digestibility of the crude fiber and the nitrogen-free extract diminishes, and a somewhat larger amount of nitrogen in the form of secretions (mucin, biliary products, etc.) appears in the feces than when the same ration is fed without the addition of carbohydrates. Numerous experiments by Henneberg, E. Schulze and M. Maercker, G. Kühn, Stohmann, and others have thrown light upon this point.

An increase of the fat in the ration appears, from the observations made, to have no effect on the digestibility of the other constituents of the food. Possibly the action of a one-sided increase of the protein in increasing the digestibility and the reverse action of the carbohydrates is due to the favorable effect on the development of different kinds of bacteria, which play an important though different part in digestion.

Concerning the extent of the so-called depression in digestibility due to carbohydrates, and of the increase of digestibility due to protein, the investigations thus far made only admit of the very general deduction that the larger the amount of nitrogen-free materials added and the more the nutritive ratio is widened, the greater the amount of crude fiber and nitrogen-free extract which remains undigested, and *vice*

[1] Landw. Vers. Stat., 44 (1894), p. 188; 46 (1895), p. 193 (E. S. R., 6, p. 12, and 7, p. 553).

versa. Exact numerical relations can not be established, as the natural variations in digestibility, as well as the unavoidable errors connected with the experiments, are sufficiently large to prevent obtaining exact data for the depression in digestibility. The investigator on this point should proceed very carefully and should make the separate periods as long as possible.

According to our present knowledge, it is very desirable in conducting ordinary experiments on the digestibility of feeding stuffs to avoid rations with extreme nutritive ratios.

ACCURACY OF THE RESULTS OF DIGESTION EXPERIMENTS.

The so-called digestion coefficients are, of course, not absolutely exact, for they include all the errors of the work and are affected by the individuality and by temporary variations in the digestive ability of the experimental animals. Every large series of digestion experiments with a feeding stuff shows variations in the digestion coefficients. To make this clear the writer has calculated the variations in 57 separate experiments with steers fed meadow hay alone, and has found the following variations in the digestion coefficients obtained with one and the same animal in different trials:

Variations in digestion coefficients for meadow hay by the same steer in different trials.

	Average variation.	Maximum variation.
	Per cent.	*Per cent.*
Dry matter	0.8	3.1
Organic matter	.8	3.3
Crude protein	2.0	5.6
Nitrogen-free extract	.9	3.3
Crude fat	2.5	11.4
Crude fiber	1.3	4.4

The significance of these figures may be shown by an example. Suppose the digestibility of wheat bran is to be determined. An experiment is first made with average meadow hay, and following this an experiment in which 10 kg. of this hay and 2 kg. of wheat bran are fed. The variations which may occur in the nutrients digested from the hay are as follows:

Variations in amount of nutrients digested from meadow hay.

	In 10 kg. of meadow hay.	Variations in the digested substance.	
		Average.	Maximum.
	Grams.	*Grams.*	*Grams.*
Dry matter	8,630	69	268
Organic matter	7,985	64	248
Crude protein	916	18	51
Nitrogen-free extract	4,292	39	142
Crude fat	254	6	29
Crude fiber	2,523	33	111

In calculating the digestibility of wheat bran from the results of the experiment with meadow hay and bran the figures obtained for meadow hay when fed alone must be employed. The errors attaching to the latter figures are therefore transmitted to the figures for wheat bran, and amount to the following in percentage of the constituents of the wheat bran:

Variations in digestibility of wheat bran.

	In 2 kg. of wheat bran.	Variations in the coefficients of digestibility.	
		Average.	Maximum.
	Grams.	*Per cent.*	*Per cent.*
Dry matter	1,736	4.0	15.4
Organic matter	1,620	4.0	15.3
Crude protein	282	6.3	18.1
Nitrogen-free extract	1,120	3.5	12.9
Crude fat	74	8.1	39.2
Crude fiber	144	22.9	77.1

Hence, when only two experiments are made, one with hay and the other with hay and wheat bran, there is danger that the coefficients of digestibility obtained by the most careful work may vary from the actual by ± 9 per cent in the case of crude protein, ± 6.4 per cent with the nitrogen-free extract, ± 19.6 per cent with the crude fat, and ± 38.5 per cent with the crude fiber. It is plain from this that single experiments give results of very uncertain value, which are almost entirely lacking in significance. Weight can be given only to the averages of many experiments, and only such averages can be regarded as decisive. This should be borne in mind, especially in cases in which comparative experiments are made with the same feeding stuff prepared for feeding in different ways, or on the effect on the digestibility of some added material.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The proteids of lupine seeds, T. B. OSBORNE and G. F. CAMPBELL (*Connecticut State Sta. Rpt. 1896, pp. 342–368*).—The author reviews the literature on the subject and reports investigations on the seeds of yellow and blue lupine. It was found that the seeds of yellow lupine contain "a small quantity of proteid that is soluble in pure water, a large quantity soluble in salt solutions, a small amount soluble in potash water, and a little nitrogenous matter, presumably proteid, which can not be extracted by these solvents." The proteids of each class were prepared, purified, analyzed, and their characteristic reactions determined. In the case of blue lupine the proteids soluble in water and in salt solution were prepared and examined. In all 48 preparations of the proteids in yellow and blue lupine seed were made and analyzed. The results of the investigation are summarized by the authors as follows:

"Both yellow and blue lupine seeds contain very little proteid matter soluble in water. The total quantity of proteid soluble in pure water obtained from the yellow lupine amounted to only 0.37 per cent. Of this a part consists of proteose. Whether the remainder is albumin or a globulin soluble in extremely dilute salt solutions, which therefore could not be completely separated by dialysis, was not determined. Peptone is not contained in the freshly ground seed, but is formed in small quantity after prolonged contact with water.

"The greater part of the proteid matter contained in these seeds is soluble in saline solutions, the yellow lupine yielding 26.2 per cent. This is the body known as conglutin, but as heretofore described and as usually obtained it is contaminated with other substances present in the seed. Preparations from the blue lupine are usually much purer than those from the yellow, for the latter contain a considerable quantity of some sulphur-containing substance from which conglutin can be separated by fractional precipitation out of dilute salt solutions. This explains why Ritthausen's conglutin from the yellow lupine contained twice as much sulphur as that from the blue lupine.

"When purified no difference in properties and reactions can be detected between preparations from the 2 seeds.

"The composition of conglutin as obtained by us is shown by the following figures:

Conglutin.

	Yellow lupine.	Blue lupine.
	Per cent.	*Per cent.*
Carbon	50.91	51.13
Hydrogen	6.88	6.86
Nitrogen	17.93	18.11
Sulphur	.52	.32
Oxygen	23.76	23.58
	100.00	100.00

"Conglutin is readily soluble in sodium chlorid solutions containing upward of 5 per cent of the salt. By sufficient dilution it is precipitated, a sirupy liquid separating which is rendered opaque and solid by treatment with water. Dissolved in salt solution, it is apparently unaffected by prolonged heating in a boiling water bath, but solutions thus heated on standing and cooling form a solid opalescent jelly, which becomes clear and fluid on again heating. Unlike other globulins, conglutin does not yield insoluble (coagulated) products by washing with alcohol or drying.

"After exhausting lupine meal with salt solution a small quantity of proteid can be extracted by 0.2 per cent potash water, from which it is precipitated by adding acetic acid in slight excess, but not by making the solution neutral to litmus. Only one preparation of this substance was made, which gave the following results on analysis:

Proteid soluble in potash water.

	Per cent.
Carbon	51.40
Hydrogen	6.79
Nitrogen	16.43
Sulphur	1.03
Oxygen	24.35
	100.00

"Owing to the insolubility of this substance in any but alkaline fluids and the difficulty of making preparations of known purity nothing further was learned respecting it."

Effect of minute quantities of acid on the solubility of globulin in salt solutions, T. B. OSBORNE and G. F. CAMPBELL (*Connecticut State Sta. Rpt. 1896, pp. 369–373*).—In investigations on the proteids of the castor bean (E. S. R., 4, p. 934) it was found that the principal globulin was partly soluble and partly insoluble in a saturated salt solution, and that these 2 parts are alike in composition but slightly different in reactions. Later a proteid was found in sunflower seed (p. 516) having similar composition and properties, which led the authors to a further study of the globulin of the castor bean with a view to discovering the cause of the partial insolubility in a saturated salt solution.

Preparations were made of the fractions of the globulin soluble in cold 10 per cent brine and not precipitated by saturation with salt (A) and of those soluble in cold and hot 10 per cent brine, respectively (B and C), but insoluble in saturated brine. Analysis showed that the difference in composition of these preparations "barely exceeds the usual errors of analysis, although several determinations of each element in the different fractions indicate that these differences are not due to analytical errors."

In order to study the effect of minute quantities of acid on these fractions of globulin 2 gm. of each were treated with 20 cc. of 0.05 per cent acetic acid, which caused no noticeable solution of the proteids. Two grams of salt was added to each, whereby A was largely, B partly, and C only slightly, dissolved. Heated to 50° A gave a clear solution, B a nearly clear solution, and C dissolved only partly and precipitated on cooling to 20°. A solution of A was prepared in the same manner, omitting the acid. It was found "that a quantity of acid too small to be detected with litmus or by analysis causes changes in the fractions soluble in saturated salt solution (A) whereby products result having the same general properties as those exhibited by the fractions B and C."

The experiments were repeated and extended, using crystallized edestin from hemp seed.

"Here again we see that the addition of a quantity of acid, too small to detect after the solution has been made, brings about changes similar to those naturally occurring in the seeds and extracts of the castor bean and sunflower and to those following the addition of acid to that part of the globulin of the castor bean which is soluble in saturated salt solutions.

"Whether such changes occur only through the influence of acids is a question not settled, and regarding which some doubt is raised by the fact that preparations of crystallized edestin which were originally soluble in 10 per cent sodium chlorid solution, with the exception of a small quantity of 'albuminate' and yielded solutions which gave only traces of precipitates on saturating with sodium chlorid, were found, after keeping dry and in cork-stopped bottles 2 and 4 years, to have become largely insoluble in cold salt solution and to yield solutions which were nearly completely precipitated by saturating with salt. The insoluble portion dissolved nearly completely in 10 per cent brine at 60° to a solution precipitated somewhat by cooling to 20° and abundantly at lower temperatures, copiously precipitated by dilution with an equal volume of water, and almost completely precipitated by saturating with sodium chlorid. It is not at all impossible that this change, too, may have been caused by acid, for these preparations stood during several years in the laboratory, the air of which at times contained some acid vapors."

It is believed that this change of the globulin to a condition in which it is precipitated by salt is an intermediate step toward the formation of the insoluble form, the so-called "albuminate" of Weil.

The proteids of the sunflower seed, T. B. OSBORNE and G. F. CAMPBELL (*Connecticut State Sta. Rpt. 1896, pp. 374–379*).—Crushed sunflower seed from which a large part of the woody shells had been removed was ground under benzin, and after freeing from oil was air dried and treated with a 10 per cent brine. From the extract a considerable quantity of proteid could be separated by dilution, by dialysis, or by saturation with salt.

Preparations were made and analyzed, indicating the principal proteid of the sunflower seed to be a globulin, but the preparations were found to be impure, containing helianthotannic acid. Attempts were then made to prepare globulins free from helianthotannic acid by extracting the meal with alcohol before precipitating the proteid, but "it was found practically impossible to remove the acid so completely as to obtain no yellow reaction when the extract was treated with potash." The composition of 3 preparations was as follows:

Composition of sunflower globulin.

	Preparation 10.	Preparation 12.	Preparation 13.
	Per cent.	*Per cent.*	*Per cent.*
Carbon	51.27	51.58	51.54
Hydrogen	6.55	6.55	6.99
Nitrogen	18.21	18.29	18.58
Sulphur	.78	.97	1.00
Oxygen	23.25	22.61	21.71
	100.00	100.00	100.00
Ash	.31	.29	.47

Preparation 13 was the purest and was very nearly white in color. The characteristics and reactions of the globulin are described:

"In composition and reaction this preparation agrees with the globulin edestin except that a part is precipitated by saturating its solutions in brine with sodium chlorid. In composition the part precipitated by saturating with salt and that remaining in solution are alike. . . .

"As helianthotannic acid contains about 53 per cent of carbon, the presence of 2 per cent of this acid in our preparation would but slightly raise the figures obtained for carbon and reduce those for nitrogen by about 0.35 per cent. The composition of the purer preparations which we have obtained differ from edestin to about this extent.

"It is therefore our opinion that the sunflower seed contains as its principal proteid the globulin edestin, but that as obtained by extraction from the seed, this is mixed with helianthotannic acid, from which we have not succeeded in separating it completely."

Vines states that if the aleurone grains of sunflower seed are treated with alcohol the globulin of which these grains consist behaves like vitellin, *i. e.*, dissolves in a saturated solution of sodium chlorid; but the authors were unable to confirm these observations.

Proteids of the cowpea, T. B. OSBORNE and G. F. CAMPBELL (*Connecticut State Sta. Rpt. 1896, pp. 380-386*).—The material examined was prepared by coarsely grinding the peas, separating the black seed coats by winnowing, and then grinding the coarse meal to a fine flour. The method of treatment by which 13 preparations were made and the composition and characteristics of these preparations are given in detail. The authors summarize the results of their investigation as follows:

"(1) The chief proteid of the cowpea is a globulin, much resembling the legumin of the pea and vetch, but essentially different in composition and properties, for which we propose the name vignin. Its composition, as found by the average of closely agreeing analyses of nine fractional precipitates, is as follows:

Vignin.

	Per cent.
Carbon	52.64
Hydrogen	6.95
Nitrogen	17.25
Sulphur	.50
Oxygen	22.66
	100.00

"(2) Besides vignin, the cowpea contains a globulin which has the composition and, so far as could be determined, the properties of phaseolin, which we have found in the kidney bean (*Phaseolus vulgaris*), and the adzuki bean (*Phaseolus radiatus*). . . .

"The composition of phaseolin as obtained from different seeds is shown by the following statement:

Phaseolin from different legumes.

	Cowpea.	Kidney bean.	Adzuki bean.
	Per cent.	*Per cent.*	*Per cent.*
Carbon	52.27	52.58	52.56
Hydrogen	6.97	6.84	6.97
Nitrogen	16.69	16.47	16.45
Sulphur	.50	.56	.57
Oxygen	23.57	23.55	23.45
	100.00	100.00	100.00

"(3) The cowpea contains a third globulin, extremely soluble in very dilute salt solutions, which could be precipitated but partially by dialysis in water and completely only in the coagulated form by dialysis in alcohol. This substance closely resembles in properties and composition bodies obtained from several other leguminous seeds. Its composition, as found by analysis of 2 precipitates, one obtained by dialysis in water and the other by further dialysis in alcohol, is as follows:"

	Per cent.
Carbon	53.25
Hydrogen	7.07
Nitrogen	16.36
Sulphur	1.11
Oxygen	22.21
	100.00

Proteid of the white-podded Adzuki bean, T. B. OSBORNE and G. F. CAMPBELL (*Connecticut State Sta. Rpt. 1896, pp. 387-390*).—The object was to determine the nature of the globulin forming the chief proteid constituent of the bean, hence the other proteid substances occurring in small quantity were not studied. The analyses of 5 preparations showed the globulin to be identical in composition with phaseolin as obtained from the white bean,[1] and the reactions were found to be the same. In the solution from which the phaseolin had been removed from the extract with ammonium sulphate a second precipitate was obtained by saturation with ammonium sulphate, which was purified and analyzed, and was found to be similar in composition

[1] Connecticut State Sta. Rpt. 1893 (E. S. R., 5, p. 1080).

to preparations obtained in a like manner from the pea, vetch, and cowpea. The authors are of opinion that it is a distinct globulin, and propose to study the matter further.

The amount and properties of the proteids of the maize kernel, T. B. OSBORNE (*Connecticut State Sta. Rpt. 1896, pp. 391–397*).—This is a continuation of work on the proteids of corn reported in the Annual Report of the station for 1891 (E. S. R., 3, p. 768). The proteids of corn are grouped under the following heads:

"(1) Proteid, soluble in pure water, having some of the properties of proteose.

"(2) Globulins, insoluble in pure water, but soluble in salt solutions.

"(3) Proteid, insoluble in water and salt solutions, but soluble in alcohol of 60 to 99 per cent.

"(4) Proteid matter, insoluble in water, salt solutions and alcohol, but soluble in dilute alkalies and acids."

The author believes that no true albumin exists in the corn kernel. The proteid soluble in saline solutions called in the previous paper "maize myosin" it is now proposed to call "maysin." Yellow corn meal was found to contain 0.25 per cent of maysin. After separating the maysin from the extract of corn meal by dialysis, further prolonged dialysis precipitated a small quantity of another globulin which the author thinks is identical with what was formerly believed to be "albumin," obtained by precipitation with salt and acid. Only 0.03 per cent of this maize globulin was found, although the author believes the amount may be 0.04 per cent. A new determination of the edestin showed 0.06 per cent. The proteid soluble in dilute alcohol, zein, comprising about 5 per cent, is described at considerable length. The proteid matter soluble in alkalies amounted to 3.15 per cent. Its composition is given, but very little else is known regarding it.

The proteid constituents of 100 gm. of yellow corn meal together with the nitrogen content of each are given approximately as follows:

Proteids in 100 gm. of corn meal.

	Amount of proteid.	Nitrogen content of proteid.	Amount of nitrogen.
	Grams.	*Per cent.*	*Grams.*
Proteid soluble in water—proteose	0.06	17.00	0.0102
Globulins soluble in salt solutions:			
Maysin	.25	16.70	.0417
Edestin	.10	18.10	.0181
Very soluble globulin	.04	15.25	.0061
Proteid soluble in dilute alcohol—zein	5.00	16.13	.8065
Proteid matter soluble in 0.3 per cent potash solution	3.15	15.82	.4983
Total nitrogen in proteids			1.3809
Nitrogen undissolved by dilute potash solution			.1645
Total nitrogen			1.5454

The nitrogen found in corn meal by analysis was 1.54 gm., equal to 15.40 per cent. The average nitrogen content of the corn proteids is given as 16.057 per cent.

The determination of citrate-soluble phosphoric acid in Thomas slag, O. BÖTTCHER (*Chem. Ztg., 2 (1897), No. 78, pp. 783, 784*).—In a previous article[1] the author discussed Wagner's citrate method and proposed a modification. As a result of further study he proposes the following: The phosphoric acid is brought into solution according to Wagner, 5 gm. of the slag (without trituration and sifting) being brought into a half liter flask and the latter filled to the mark with Wagner's dilute ammonium citrate solution at a temperature of 17.5° C. The flask is closed with a rubber stopper and kept for 30 minutes in a rotary machine making 30 to 40 revolutions per minute. The solution is filtered at once, the entire liquid being brought into a large filter, or it is poured off into another vessel and then filtered. As soon as possible, at least within a day, 50 cc. of this clear filtrate is treated with 50 cc. of Maercker's citrate solution and 25 cc. of Maercker's magnesia mixture, the whole agitated for 30 minutes in a shaking apparatus, and as soon as possible filtered through a Gooch crucible, dried, ignited 3 or 4 minutes in a Rössler furnace, cooled in a desiccator and weighed.—J. T. ANDERSON.

The proteids of lupine seeds; Effect of minute quantities of acid on the solubility of globulin in salt solutions; The proteids of the sunflower seed; The proteids of the cowpea; Proteid of white-podded adzuki bean, T. B. OSBORNE and G. F. CAMPBELL (*Jour. Amer. Chem. Soc., 19 (1897), No. 6, pp. 454-500, 509-513*).—This series of papers is reprinted from the Annual Report of the Connecticut State Station for 1896 (E. S. R., 9, pp. 514-518).

The amount and properties of the proteids of the maize kernel, T. B. OSBORNE (*Jour. Amer. Chem. Soc., 19 (1897), No. 7, pp. 525-532*).—This paper is reprinted from the Annual Report of the Connecticut State Station for 1896 (E. S. R., 9, p. 519).

The alkaloids of white and blue lupine, S. DAVIS (*Arch. Pharm., 235 (1897), No. 3, pp. 199-240, pl. 1; abs. in Bul. Soc. Chim. Paris, 3. ser., 18 (1897), No. 18-19, pp. 1116, 1117, and Jour. Chem. Soc. [London], 72 (1897), No. 421, I, p. 645*).

The lupinin and lupinidin of yellow lupine, L. BEREND (*Arch. Pharm., 235 (1897), No. 4, pp. 262-289; abs. in Bul. Soc. Chim. Paris, 3. ser., 18 (1897), No. 18-19, p. 1117, and Jour. Chem. Soc. [London], 72 (1897), No. 421, I, p. 645*).

Alkaloids of black and perennial lupines, K. GERHARD (*Arch. Pharm., 235 (1897), No. 5, pp. 342, 355; abs. in Bul. Soc. Chim. Paris, 3. ser., 18 (1897), No. 18-19, p. 1118, and Jour. Chem. Soc. [London], 72 (1897), No. 421, I, p. 646*).

On the alkaloids of white lupines, A. SOLDIANI (*Arch. Pharm., 235 (1897), No. 5, p. 368; abs. in Bul. Soc. Chim. Paris, 3. ser., 18 (1897), No. 18-19, p. 1117, and Jour. Chem. Soc. [London], 72 (1897), No. 421, I, p. 646*).

On the alkaloids of lupine seeds, E. SCHMIDT (*Arch. Pharm., 235 (1897), No. 3, pp. 192-198; abs. in Bul. Soc. Chim. Paris, 3. ser., 18 (1897), No. 18-19, p. 1116, and Jour. Chem. Soc. [London], 72 (1897), No. 421, I, p. 645*).

Alkaloids of the seeds of Lupinus affinus, K. GERHARD (*Arch. Pharm., 235 (1897), No. 5, p. 363; abs. in Bul. Soc. Chim. Paris, 3. ser., 18 (1897), No. 18-19, p. 1118, and Jour. Chem. Soc. [London], 72 (1897), No. 421, I, p. 646*).

Action of halogens on albuminoids, F. G. HOPKINS (*Ber. Deut. Chem. Gesell., 30 (1897), p. 1860; abs. in Chem. Ztg., 21 (1897), No. 87, Repert., p. 246*).

An improved method of determining proteid and gelatinoid substances, A. H. ALLEN and A. B. SEARLE (*Analyst, 22 (1897), Oct., pp. 258-263*).—In this method bromin instead of chlorin is used in analyzing meat extracts, etc.

[1] Chem. Ztg., 21 (1897), No. 19, p. 168 (E. S. R., 9, p. 114).

Note on the determination of proteids by chlorin, S. RIDEAL and C. G. STEWART (*Analyst, 22 (1897), Sept., pp. 228–235*).—This relates to the determination of albuminoids in meat and meat extracts. The method is described.

A substitute for hide powder for use in the determination of tanning materials, W. SCHMITZ-DUMONT (*Ztschr. Öffentl. Chem., 3, p. 209; abs. in Analyst, 22 (1897), Sept., p. 248*).—Favorable results were obtained with a preparation of formalin-gelatin.

The yellow coloring principles of various tannins, A. G. PERKINS (*Jour. Chem. Soc. [London], 71 (1897), No. 419, pp. 1131–1138*).

Note on the indirect (Tabarie's) method for the estimation of alcohol, N. LEONARD and H. M. SMITH (*Analyst, 22 (1897), Sept., pp. 225–228*).

Beta-naphthalene sulphonic acid as a reagent for albumin, albumoses, and peptones, E. RIEGLER (*Pharm. Centralhalle, 38 (1897), p. 379; abs. in Analyst, 22 (1897), Oct., p. 274*).

Studies on cane sugar, H. PELLET (*Ann. Sci. Agron., 1897, I, No. 3, pp. 415–473; II, No. 1, pp. 1–74, figs. 9*).

Detection of arachis meal and arachis cake in chocolate, BILTERYST (*Jour. Pharm. et Chim., 6. ser., 6 (1897), pp. 29, 30; abs. in Jour. Chem. Soc. [London], 72 (1897), No. 420, II, p. 529*).

The detection of formalin in milk by means of phloroglucinol, M. JORISSEN (*Service de Surveillance des Aliments en Belgique; abs. in Analyst, 22 (1897), Nov., p. 282*).—About 10 cc. of milk is shaken with a few drops of a 10 per cent aqueous solution of phloroglucinol and a little caustic soda or potash added. Milk containing as little as 1 part of formalin in 20,000 gives a red coloration, while normal milk gives no reaction.

The richness of milk in mineral matter and earth phosphates, U. L. VANDIN (*Ztschr. Nahr. Untersuch. u. Hyg., 11 (1897), No. 19, pp. 320–322*).

On the cryoscopy of milk, A. PONSOT (*Bul. Soc. Chim. Paris, 3. ser., 17 (1897), pp. 840, 841; abs. in Chem. Centbl., 1897, II, No. 16, p. 866*).—A discussion of the employment of the point of crystallization as a means of detecting adulteration of milk.

Determination of milk sugar in milk, A. ORTMANN (*Ztschr. Nahr. Untersuch. u. Hyg., 11, pp. 265, 266; abs. in Chem. Centbl., 1897, II, No. 15, p. 814*).

Adulteration of milk with sweetened water, VON COTTON (*Répert. Pharm., 3. ser., 9 (1897), p. 390; abs. in Chem. Ztg., 21 (1897), No. 87, Repert., p. 251*).—A sample of milk adulterated with sugar and water gave the same lactometer reading as pure milk. The adulterant was detected by the reaction which ammonium molybdate in acid solution gives with milk sugar as compared with cane sugar.

Preliminary examination of cheese, A. FORSTER and R. RIECHELMANN (*Ztschr. Öffentl. Chem., 3, p. 159; abs. in Analyst, 22 (1897), Sept., p. 235*).—It is advised to cut the cheese into small pieces and treat it in Gerber's butyrometer with hot water and sulphuric acid. The fat column is read off. The results are compared with those obtained by the methods of von Raumer and Bremer on different kinds of cheese.

Detection of margarin in cheese, H. BREMER (*Forsch. Ber. Lebensmtl., 4 (1897), pp. 51–53; abs. in Analyst, 22 (1897), Oct., p. 265*).

Estimation of potassium bitartrate in wines, H. JAY (*Ann. Chim. Analyt. et Appl., 2 (1897), pp. 264–267; abs. in Analyst, 22 (1897), Nov., p. 283*).

Estimation of potassium bitartrate and free tartaric acid in wines, L. MAGNIER DE LA SOURCE (*Ann. Chim. Analyt. et Appl., 2 (1897), pp. 281–283; abs. in Analyst, 22 (1897), Nov., p. 284*).

New method of estimating tartaric acid in wine, L. BRIAND (*Ann. Chim. Analyt. et Appl., 2 (1897), p. 321; abs. in Analyst, 22 (1897), Nov., p. 283*).

Wine analysis, B. HAAS (*Ztschr. Nahr. Untersuch. u. Hyg., 11 (1897), Nos. 8, pp. 122–124; 9, pp. 137–140; 10, pp. 153, 154*).—Gives methods discussed and adopted by the Association of Austrian Experiment Stations.

A note on the analysis of wine, S. WEINWURM (*Ztschr. Nahr. Untersuch. u. Hyg., 11 (1897), No. 14, p. 234*).

Adulteration of sumach, M. SPICA (*Gaz. Chim. Ital., 27 (1897), No. 1, pp. 349–358; abs. in Jour. Chem. Soc. [London], 72 (1897), No. 420, II, p. 530*).

Microchemical reaction for nitric acid, J. L. C. SCHROEDER VAN DER KOLK (*Jahrb. Min., 1897, I, p. 219; abs. in Jour. Chem. Soc. [London], 72 (1897), No. 420, II, p. 516*).—"The substance to be tested is placed with a drop of sulphuric acid in the hollow in a glass slide, and from the cover glass hangs a drop of barium hydroxid solution; when nitric acid is driven off, typical crystals of barium nitrate appear in the drop on the cover glass. As the substance tested does not come in contact with the barium solution, the presence of sulphates, phosphates, etc., does not affect the result."

Determination of nitric acid by means of formic aldehyde, and vice versa, VON COTTON (*Répert. Pharm., 3. ser., 9 (1897), p. 450; abs. in Chem. Ztg., 21 (1897), No. 89, Repert., p. 254*).—Formic aldehyde and nitric acid decompose each other with the formation of nitrogen and carbon dioxid, the reaction being quite rapid in concentrated solutions, but very slow in weak solutions. It is suggested that a method for the determination of nitric acid may be based on this reaction, but it could be applied with success only in comparatively concentrated solution.

Nitric acid in river and reservoir water, T. SCHLÖSSING (*Ann. Sci. Agron., 1897, II, No. 1, pp. 75–119, figs. 6*).

BOTANY.

Lability and energy in relation to protoplasm, O. LOEW (*Imp. Univ. Col. Agr. [Tokyo] Bul., vol. 2, No. 7, pp. 393–405*).—The author reviews the work of himself and others relative to some of the physiological phenomena manifest by protoplasm. Some of the author's discoveries relative to albumin, asparagin, aldehyde, and amido compounds have been given elsewhere (E. S. R., 6, pp. 111, 383).

The author summarizes his theoretical views as follows:

"(1) Albumin is formed by condensation of the still hypothetical aspartic aldehyde which in plant cells either is produced from asparagin or built up of formic aldehyde and ammonia.

"(2) There is a chemical difference between the *albumin* of the living and that of the dead protoplasm.

"(3) The labile, active albumin leads by organization to living matter, as such, and in the form of nuclein and nucleo-albumin.

"(4) The lability of the albumin of the living protoplasm is caused by the presence of aldehyde and amido groups.

"(5) The conversion of the albumin of the living to that of the dead protoplasm presents a remarkable analogy to the change of a labile substance into a stable modification."

The actual observations which tend to substantiate his hypotheses are also given, as follows:

"(1) There exist intimate physiological relations between asparagin and albumin; the former is an excellent material for building up the latter. The formation of albumin often takes place with great rapidity.

"(2) The living protoplasm shows a chemical behavior totally different from that of the dead.

"(3) There frequently occurs in plants, as reserve material, a highly labile kind of albumin of aldehyde character, whose chemical nature is altered by the same influences as those by which the protoplasm is killed.

"(4) Compounds which react upon aldehydes and such as react upon labile amido-groups with great energy are poisonous for all organisms.

"(5) The transition of living protoplasm into dead is accompanied by contraction and development of heat."

The formation of mannan in Amorphophallus konjak, M. Tsukamoto (*Imp. Univ. Col. Agr.* [*Tokyo*] *Bul., vol. 2, No. 7, pp. 406–408*).—The tuber of this araceous plant is used in Japan as an article of diet and is of interest on account of its containing no starch but a very large amount of mannan. Examinations made of the leaves of the plant showed very small quantities of starch, some mannose, but neither pentosans nor galactans.

Investigations made to determine whether mannose as such occurred in the leaf showed that the slimy mannan was present in the cells of the leaf, making it probable that it plays to some extent the rôle of starch in assimilation, but the exact rôle of mannose is not yet determined. The presence of mannose as such in the petioles of the leaves is highly interesting, it being the first time it has been so reported.

The formation of asparagin in plants under different conditions, U. Suzuki (*Imp. Univ. Col. Agr.* [*Tokyo*] *Bul., vol. 2, No. 7, pp. 409–457*).—A series of experiments with a number of different plants was conducted in which the formation of asparagin was investigated. The methods of experimentation and the analytical data from which the conclusions are drawn are given in detail.

As a result of his observations the author concludes that asparagin in plants has two sources (1) from the decompositions of proteids and (2) as a synthetical product of ammonia salts, urea, and nitrates.

It is formed in full-grown plants not only in the dark, but under some conditions in the light. The synthetic formation of asparagin is possible only when sugar is present and some condition for protein formation is wanting. Excess of sugar prevents the formation of asparagin from proteids, but stimulates its synthetic production.

Ammonia as such is seldom found stored in plants, it usually being quickly transformed into innocuous compounds. When the necessary sugar for this transformation is wanting, small quantities remain in the plant, but large amounts of ammonia are injurious.

Ammonium salts are better than sodium nitrate for asparagin production. Of the ammonium salts tested the chlorid is the most favorable to asparagin formation and the phosphate least. Urea was in most experiments better than ammonium salts for this purpose.

For the conversion of nitrates a high temperature and presence of sugar are necessary. For the conversion of asparagin into proteids sulphates are necessary.

Etiolated plants were unable, unless sugar was present, to convert sodium nitrate into asparagin, but readily transformed urea.

Can old leaves produce asparagin by starvation? T. Miyachi (*Imp. Univ. Col. Agr.* [*Tokyo*] *Bul., vol. 2, No. 7, pp. 458–464*).—The production of asparagin in plants, commonly thought to be restricted to young plants, was investigated by the author, and it was found that by starving old plants of *Peonia albiflora* the leaves were able to produce asparagin from proteids.

On the relative value of asparagin as a nutrient for phanerogams and fungi, T. NAKAMURA (*Imp. Univ. Col. Agr.* [*Tokyo*] *Bul., vol. 2, No. 7, pp. 465–470*).—The author made quantitative comparisons of asparagin and ammonium succinate as sources of nitrogen for barley, onions, and *Aspergillus oryzæ*. In the case of the phanerogams fully 50 per cent more growth was made where asparagin was added to the nutrient media than where the other compound was used. With the fungus the growth of mycelium was far in excess where asparagin was given the plant. In the series of experiments with the fungus, in addition to asparagin and ammonium succinate, numerous other compounds were also tried, with similar results.

On the quantity of nitrates stored up in plants under different conditions, T. ISHIZUKA (*Imp. Univ. Col. Agr.* [*Tokyo*] *Bul., vol. 2, No. 7, pp. 471–474*).—The effect of storage on the nitrates contained in plants was investigated, the determination of nitrates being made by the Schulze-Tiemann method. Fruits, fleshy roots, leaves, and stems of quite a number of plants were investigated and in every case there was a greater or less decrease in the quantity of nitrates present. In many cases the decrease was about proportional to the duration of the storage period. There was found in the case of radishes, carrots, and kohl-rabi an increase in asparagin coincident with the decrease in nitrates.

On the physiological behavior of maleic and fumaric acids, T. ISHIZUKA (*Imp. Univ. Col. Agr.* [*Tokyo*] *Bul., vol. 2, No. 7, pp. 484–486*).—The effect of these isomeric acids on fungi and animals shows that while fumaric acid may be utilized, maleic acid is poisonous. The author investigated their effect on some of the higher plants, using leaves, whole plants, branches and seeds, algæ, and some aquatic animals, such as infusoria, rotatoria, etc. Neutral sodium salts of the acids were used and in every case the solution containing maleic acid killed the subject in a comparatively short time, while those in the culture media containing the fumaric acid were either not injured or only after a longer time of exposure.

On the physiological action of amidosulphonic acid, N. MAENO (*Imp. Univ. Col. Agr.* [*Tokyo*] *Bul., vol. 2, No. 7, pp. 487–493*).—This acid is said to occupy an exceptional position in that it is neither poisonous to animals, fungi, or algæ, but is to all phanerogams. Although not poisonous to fungi it is not as available as a source of nitrogen as the ammonium salts.

Notes on the metabolism in the cherry tree, S. AOYAMA (*Imp. Univ. Col. Agr.* [*Tokyo*] *Bul., vol. 2, No. 7, pp. 499–502*).—The author has compared the reserve material in winter with the extent to which it is consumed in the spring during the period of flowering and leafing. The cherry trees of central and southern Japan are said to flower profusely but seldom or never bear any fleshy fruit. This results in the deposition of a large amount of reserve material. There was found a very marked reduction in the amount of proteids, fat, and carbohydrates after the flowering and leafing of the trees.

Physiological observations on lecithin, T. HANAI (*Imp. Univ. Col. Agr. [Tokyo] Bul., vol. 2, No. 7, pp. 503–506*).—Examinations were made of tea leaves and of the bark from branches of *Prunus cerasus*, from which it appears that lecithin is a reserve material in these plants and it is used up in the spring.

Investigations on the mulberry tree, N. MAENO (*Imp. Univ. Col. Agr. [Tokyo] Bul., vol. 2, No. 7, pp. 494–499*).—The effect of a special manure on the quality of mulberry leaves and the amount of reserve material in the bark of the roots and branches of the tree are reported upon. It is claimed that manuring a tree 1½ meters high with 500 gm. of lime, 400 gm. of sodium nitrate, and 200 gm. of calcium sulphate greatly improved the quality of the leaves which were to be fed to silkworms.

In the second part of the experiments specimens of roots were collected January 25 and analyzed, and comparisons made with similar material taken 3 months later. There was a decided decrease in proteids and nonnitrogenous extract and an increase in starch in the later specimens.

In the case of branches taken for analysis before and after leafing there was a decrease of proteids, fat, lecithin, and total carbohydrates following the development of the leaves.

On the presence and localization in certain pomaceous seeds of the principles producing cyanhydric acid, M. L. LUTZ (*Bot. Gaz., 24 (1897), No. 1, pp. 54–56*).—The action in the presence of water of two substances, known to exist in the seeds of certain of the Amygdalaceæ, emulsin, a ferment, and amygdalin, a glucosid, results in the formation of cyanhydric acid. As a result of the author's investigations he found amygdalin and emulsin existing together in the seeds of *Malus communis*, *Cydonia vulgaris*, *C. japonica*, *Sorbus aucuparia*, and *S. aria*. They do not occur together in *Pyrus communis*, *Cratægus oxyacantha*, *C. azarolus*, and *Mespilus germanica*.

Emulsin is localized by means of Millon's reagent and was found in numerous cells scattered throughout the cotyledons, especially in the vicinity of the woody bundles, whose endodermis also contained it.

It is stated that the glucosid, amygdalin, occurs in the cotyledons, hypocotyl, plumule, and root, but in such small quantity to be difficult to determine.

Germination does not change the localization of these two substances.

The flora of the Southern United States, A. W. CHAPMAN (*Cambridge, Mass.: The Cambridge Bot. Supply Co., 1897, 3. ed., pp. 655*).

Some new Uredineæ, P. DIETEL (*Hedwigia, 36 (1897), No. 5, pp. 297–299*).—Nine new species are described of which the following are American: *Uromyces albus*, *Puccinia chelonis*, *P. densa*, *P. antirrhini*, and *P. syndowiana*.

A new species of Eurotium aspergillus, R. MEISSNER (*Bot. Ztg., 55 (1897), II, No. 22, pp. 337–344, figs. 10*).

Cereals and field flowers, B. PLUSS (*Unsere Getreidearten und Feldblumen. Freiburg: Herder's, pp. VII, 204, figs. 200*).—This work describes the cereals, fodder plants, and field and meadow flowers.

Results of inoculation experiments with different legumes, O. BURCHARD (*Landw. Wchnbl. Schleswig-Holstein, 47 (1897), No. 42, pp. 601–603*).—Vetches, peas, and serradella were grown in large pots in soils inoculated with Nitragin. In every case there was a decided increase in yield of the inoculated over the uninoculated soils.

Concerning alinit, M. MAERCKER (*Fühling's Landw. Ztg., 46 (1897), No. 21, pp. 643–645*).—An article taken from the *Illus. Landw. Ztg.* considering the evidence of the value of alinit as a germ fertilizer for cereals. The author does not think its use advisable for any other than experimental purposes at present.

Morphology of the embryo and plantlet of some of the Gramineæ and Cyperaceæ, P. VAN TIEGHEM (*Ann. Sci. Nat. Bot., 8. ser., 3 (1897), No. 3–6, pp. 259–309*).

The morphology and physiology of the germination of Spermaphytes, A. J. J. VANDEVELDE (*De keiming der Zaadplanten, morphologie en physiologie. Gand: J. Vuylsteke, 1897, pt. 1, pp. 136*).

The morphology of the central cylinder of roots, A. KATTEIN (*Bot. Centbl., 72 (1897), Nos. 2, pp. 55–61; 3, pp. 91–97; 4, pp. 129–139, pls. 2*).

Concerning the decomposition of proteids and the formation of asparagin and glutamin by germinating plants, E. SCHULZE (*Chem. Ztg., 21 (1897), No. 63, pp. 625–628*).—The author sums up the more important recent literature bearing on this subject.

Concerning the growth of the leaves of conifers, R. MEISSNER (*Bot. Ztg., 55 (1897), I, No. 11, pp. 203–218*).

On the formation of albuminoids in plants by the reduction of nitrates, E. GODLEWSKI (*Ann. Agron., 23 (1897), No. 7, pp. 310–324*).—Translated from the German by L. Bourgeois.

Recent investigations on the importance of phosphoric acid in the plant organism (*Deut. Landw. Presse, 24 (1897), No. 77, p. 704*).—Discusses the recent work of Stoklasa showing that soluble phosphoric acid is necessary to the formation of lecithin and also chlorophyll in plants.

Action of light on diastase, J. R. GREEN (*Phil. Trans. Roy. Soc. [London], Bot. ser., 188 (1897), pp. 167–190; abs. in Ann. Agron., 23 (1897), No. 8, pp. 337–356*).—Translated from the English by E. Demoussy.

The influence of the dark heat rays upon the organism of plants, H. NILSSON (*Bot. Centbl., 72 (1897), No. 1, pp. 21–29*).

The dependence of chlorophyll function on chromophores and cytoplasm, L. KNY (*Ber. Deut. Bot. Gesell., 15 (1897), No. 7, pp. 388–403*).

Physiological investigations concerning the disposition of reserve cells, etc., K. PURIEWITSCH (*Jahrb. Wiss. Bot. [Pringsheim], 31, No. 1, pp. 1–76*).

Concerning the suppression of the nucleus by the development of the embryo sac, etc., D. M. MOTTIER (*Jahrb. Wiss. Bot. [Pringsheim], 31, No. 1, pp. 125–158, pls. 2*).

Castor seed poison and its antitoxin (*Agr. Students' Gaz., 8 (1897), No. 4, p. 102*).

The biology and physiology of the cell membrane, Z. KAMERLING (*Bot. Centbl., 72 (1897), No. 2, pp. 49–54; 3, pp. 85–91*).

The microscopic examination of cereals and flour for fungus spores and for ergot, SCHNELLER (*Ztschr. Angew. Mikros., 3 (1897), No. 1, pp. 1–4; abs. in Bot. Centbl., 72 (1897), No. 3, pp. 118, 119*).

On the number of sterigmata and spores in Agaricus campestris, E. C. HORRELL (*Jour. Linn. Soc. Bot. [London], 33 (1897), No. 229, pp. 168–171, pl. 1*).

The anatomy and physiology of the seed of sugar beets, A. NESTLER and J. STOKLASA (*Ztschr. Zuckerind. Böhemen, 21 (1897), p. 883; abs. in Bot. Centbl., 72 (1897), No. 3, pp. 120–122*).

On the hypothesis of a sugar forming diastase in sugar beets, G. ARACHEQUESNE (*Jour. Distil. Francaise, 1897, No. 664, pp. 82, 83*).

Influence of environment in the origination of plant varieties, H. J. WEBBER (*U. S. Dept. Agr. Yearbook 1896, pp. 89–106*).—A popular article. It discusses the effects of food supply, water, light, temperature, sea air, sea water, and change of climate on inducing variations in plants. Many specific examples of variations brought about through these agencies are noted. Illustrations are given comparing the pyramidal form of red cedar trees grown on rich moist soil with the shrubby, spreading, irregular form grown on dry, barren soils. Similar illustrations are given comparing the cultivated and swamp forms of bald cypress, the alpine and ordinary forms of dandelion, and the maritime, sand-dune, and cultivated forms of sea grape. How to induce desired variations and the formation of varieties by selection are discussed.

Parasitism of Cucurbitaria berberidis (*Jahresber. Zürcher. Bot. Gesell., 1896, p. 7*)

Microphotography, A. L. CLEMENT (*Le Photomicographie. Paris: C. Mendel, 1897, pp. 122, figs. 95*).

Some common poisonous plants, V. K. CHESNUT (*U. S. Dept. Agr. Yearbook 1896, pp. 137–146, figs. 5*).—The author believes that the number of poisonous plants in the United States has been underestimated. All plants which have ever produced ill effects are to be regarded tentatively as poisonous. The following plants are considered: Poison ivy (*Rhus radicans*), poison oak (*R. diversiloba*), poison sumac (*R. vernix*), water hemlocks (*Cicuta maculata, C. bulbifera, C. vagans,* and *C. bolanderi*), death cup (*Amanita phalloides*), and fly amanita (*A. muscaria*). Descriptions, illustrations, toxic effects, and antidotes, when known, are given.

ZOOLOGY.

The blue jay and its food, F. E. L. BEAL (*U. S. Dept. Agr. Yearbook 1896, pp. 197–206, figs. 3*).—Contrary to the statements of reliable observers that the blue jay (*Cyanocitta cristata*) robs other birds of their eggs and young, an examination of nearly 300 blue jay stomachs did not show such a habit to be common. An analysis of the contents of this large number of stomachs of birds, collected in every month of the year from 22 States, the District of Columbia, and Canada, demonstrates that fully three-fourths (75.7 per cent) of the bird's food consists of vegetable matter, and that the proportion of animal food is greatest during June, July, and August, and reaches its highest (66 per cent, rising from 1 per cent in January) during August.

In this amount of animal food, the proportion of injurious insects is largely in excess of all other animal matter, including beneficial insects. The greatest number of predaceous beetles were found in the stomachs in July, when their proportion reached 10.25 per cent of the total food. They consisted generally of the blunt-jawed genera, such as Harpalus, Cratacanthus, and Stenolophus.

Scarabæids were found in maximum quantity (8.8 per cent) in August and were mostly represented by the goldsmith beetle (*Cotalpa lanigera*), the spotted grapevine beetle (*Pelidnota punctata*), the brilliant tumblebug (*Phanæus carnifex*), along with May beetles (*Lacnosterna* sp.) and the fruit-destroying beetles (*Euphoria inda* and *E. fulgida*). Orthoptera form about 4.4 per cent of the total amount of food and reach their highest proportion (19.5 per cent) in July. Caterpillars are an important element only in March, August (11.4 per cent), and September. Insect eggs are frequently met with.

In eleven cases egg shells were found, but these were identified as those of common hens' eggs or of a bird of equal size. In no instance was evidence found of the eggs of wild birds.

The vegetable food consists of grain, mast, seeds, fruit, and miscellaneous fragments. The grain, except corn, forms only an insignificant part (1.3 per cent). Corn aggregates 17.9 per cent of the annual food, but is over 3 per cent less than that eaten by the crow and about 17 per cent less than that eaten by the crow blackbird. In January it amounts to 56 per cent of the food. Mast is a fairly constant element compared with corn, averaging 42 per cent, and seems to be preferred. The amount of fruit eaten reaches more than 35 per cent in July, but it does not demonstrate serious depredations upon cultivated fruit.

In an experiment with a bird in captivity, it was found that scarabæids were preferred to carabids or tenebrionids, though none were rejected. Crysomelids, however, were generally rejected. Elaterids were preferred to cerambycids.

The extermination of noxious animals by bounties, T. S. PALMER (*U. S. Dept. Agr. Yearbook 1896, pp. 55–68*).—The author considers the demand for bounties, and notes that the most persistent demands have come from sheep and cattle owners. The history of bounty legislation in the United States is reviewed, and the requisites of any scheme for the extermination of a species in order to be practical are summarized. Notwithstanding the apparent simplicity and economy of the bounty system, it has proved costly and unsatisfactory in practice, as seems to be attested by the fact that over 300 laws have been enacted in the United States.

In the Great Plains region the warfare upon the rodents has proved very expensive and ineffective. Since 1875 great efforts have been made against hawks and owls. The cost of such laws is shown by estimates to greatly exceed the good they do. In Pennsylvania nearly $90,000 was expended to prevent an estimated possible loss of $1,875 to the poultry industry and at the same time to destroy birds that might have saved an estimated damage of $3,857,130 from mice, upon which they chiefly live.

It is estimated that the total expenditure for bounties in the various States and Territories during the last quarter century aggregates more than $3,000,000. In 29 States and Territories from which data were more or less completely collected there has been an expenditure of $2,387,361.

The objections to the bounty system are thought to be serious.

The great objection where the bounty is paid from the county treasuries lies in the difficulty of securing uniformity of action in different counties and in the varying rates that are paid. Bounties may be so low as not to offer an inducement to destroy noxious animals and thus practically annul the law, as was the case with the Montana act of 1879, which seems to fail entirely, since county treasurers' reports failed to show any expenditure for bounties during the 4 years that the law was in force. On the other hand, if the rate is too high, the results are very disastrous, especially where the proof required is not of the proper kind or is not sufficient. This is shown by the fact that in Pennsylvania, under the scalp act, bounties were paid on the heads of domestic fowls, partridges, pheasants, cuckoos, butcher birds, and even night hawks which were accepted as those of hawks and owls; and further, that a few years ago it was more profitable in Iowa to raise coyotes for the bounty than to raise sheep. In Kentucky and New Mexico affidavits are required showing that the animals have not been raised for the rewards.

Considering the subject of what bounties have accomplished, it is shown that in the Old World, notwithstanding all the efforts made against various animals from very early times, they either have not been exterminated or were exterminated only after a very long time. Although larger animals are becoming more and more rare in this country, the author states that bounties have not brought about the extermination of a single species in any State. The rarity of wolves east of the Mississippi River is attributed to the settlement of the country, rather than to the number killed for rewards. The killing of bears has been encouraged in Maine since 1830. The last five years show no noticeable decrease in the number of scalps presented for bounty. Results have been similar in New Hampshire and in New York, and, in the case of gophers, ground squirrels, and rabbits, in Iowa, Idaho, Minnesota, South Dakota, Washington, and California.

Under the head of substitutes for bounties, there are mentioned the acceptance of scalps of crows, squirrels, and coyotes in place of taxes—a plan that was necessitated in early times—competitive hunts where prizes are offered by gun clubs, etc., and, lastly, the free distribution of poisons, a method that has been resorted to in North and South Dakota, Washington, and Manitoba.

In the summary, the author notes that the expense of bounty legislation seems to increase rather than decrease. The objections to the system are briefly summarized as follows: (1) Expense, which is usually out of all proportion to the benefit gained and may be greater than the county or State can afford. (2) Impossibility of maintaining bounties in all parts of an animal's range for any length of time. (3) Impossibility of maintaining equal rates in all States. (4) Impossibility of preventing payment for animals imported from other States, for counterfeited scalps, or for animals raised especially for the bounty. These objections, he states, have never been satisfactorily overcome, and most laws have failed from one or another of the causes noted. While rewards for wolves, coyotes, and panthers are now shown to act as a check upon the increase of these species, rewards on ground squirrels, gophers, and other small mammals have accomplished little or nothing, and bounties on birds are apt to do great harm by encouraging the killing of useful species.

The author concludes that the extermination of noxious animals is a slow process, and can be most economically and effectively accomplished through the efforts of individual landowners.

Zoology, L. C. MIALL (*Nature, 56, No. 1452, pp. 402–409*).—The presidential address before Section D at the Toronto meeting of the British Association for the Advancement of Science. It is a general survey of the subject, with hints as to the future. The address notes the need of further studies of life histories and by implication fewer attempts at species making and the compilation of lists with no object in view further than their mere compilation. The subject of alternation of generations is well brought out.

Earthworm studies: IV. A check list of British earthworms (*Zoologist, 1. ser., 4 (1897), No. 10, pp. 453–459*).—Five species of Lumbricus, 16 of Allolobophora, and 4 of Allurus are described. To a certain extent Beddard's monograph is followed. Although the author has given up the term Dendrobæna, he believes the day is coming when the genus Allolobophora will be broken into sections, one of which will be Dendrobæna. In the descriptions the plan is adopted of denoting the girdle segments and those bearing the *tubercula pubertatis* by means of a fraction, such as $\frac{30-36}{31-35}$, which denotes that the girdle extends in the adult from the 30th to the 36th segment and that the 31st to the 35th segments bear the tubercula. If the tubercula are on alternate segments the formula would be written $\frac{30-36}{31:33:35}$.

On some important sources of error in the plankton method, C. A. KOFOID (*Science, n. ser., 6 (1897), No. 153, pp. 829–832*).—The author shows that the silk strainers used do not retain more than one-half of the solid contents of the waters studied. The greatest loss occurs in waters containing Trachelomonas, Chlamydomonas, Euglena, Melosira, etc.

Suppression of the rabbit pest in Australia by use of the microbes of chicken cholera (*Nature, 56, No. 1436, p. 16*).

Flooding as a means of destroying animals injurious to forests, especially beetles and mice, as well as a means of equalizing the waterflow in water courses, L. ANDERLIND (*Ent. Nachr., 13 (1897), No. 14, pp. 209–215*).—It is shown that flooding lands for the purpose of killing pests may serve, besides this, the purpose of regulating the flow of the water in the water courses from which the water for flooding is taken.

Ferrets, their management in health and disease, with remarks on their legal status, N. EVERITT (*London: Adam & Charles Black, 1897, pp. 209, figs. 40*).

The kestrel or windhover (Falco tinnunculus) (*Bd. Agr. [London], Leaflet No. 40, pp. 3, fig. 1*).

Sparrow hawk (Accipiter nisus) (*Bd. Agr. [London], Leaflet No. 41, pp. 3, fig. 1*).

Short eared owl (Otus (Strix) brachyotus) (*Bd. Agr. [London], Leaflet No. 42, pp. 3, fig. 1*).

Titmice (Parus major and P. cæruleus) (*Bd. Agr. [London], Leaflet No. 43, pp. 4, figs. 2*).

Common lapwing, plover, or pewit (Vanellus cristatus (vulgaris) (*Bd. Agr. [London], Leaflet No. 44, pp. 3, figs. 1*).

METEOROLOGY.

Monthly Weather Review (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 25 (1897), Nos. 7, pp. 285–338, figs. 3, charts 5; 8, pp. 339–379, charts 6; 9, pp. 381–424, charts 8*).—Besides the usual summaries of meteorological data, No. 7 contains special articles on The observation of halo phenomena, by K. Schipps, and The equations of hydrodynamics in a form suitable for application to problems connected with the movements of the earth's atmosphere, by J. Cottier (see p. 533); and notes by the editor on cloud heights at Toronto, rain gushes in thunderstorms, importance of sound theories, the observation of halos, thermometer exposure, fake storms, the practical utilization of lightning, mountain storms, landslide in Vermont, the origin of the St. Louis tornado, frost formations, earthquake-proof buildings, thunderstorms in Franklinville, New York, recent earthquakes, and kites at the Chicago Conference, August, 1893.

No. 8 contains special articles on The Roentgen rays, by J. Trowbridge; The mechanics of the kite, by H. M. Decker; and Highs and lows, by N. R. Taylor; and notes by the editor on origin of descending gusts of wind, the postal telegraph clock and weather bulletin, electric waves in the atmosphere, electrical districts, lightning and magnetic rocks, the structure of hailstones, the ancient climate of Arizona, Mauritius—meteorology and crops, and practical science in Germany.

No. 9 contains special articles on The highest kite ascensions at Blue Hill, by S. P. Fergusson; Explosive noises at Franklinville, New York, by J. W. Kales; Seismic noises in North Carolina and Georgia, by B. C. Hawkins; Meteorological observations made to determine the probable state of the sky at several stations along the path of the total eclipse of the sun, May 28, 1900, by F. H. Bigelow; Forests and rainfall, by H. A. Hazen; and Report on the operation of the Mount Tamalpais Station for September, 1897, by W. H. Hammon; and notes by the editor on old weather records, recent earthquakes, depth of hail fall, high level stations in Jamaica, forms of lightning, resultant and prevailing winds, frost formation in St. Paul, and the handbooks of the deutsche Seewarte.

Storms, storm tracks, and weather forecasting, F. H. BIGELOW (*U. S. Dept. Agr., Weather Bureau Bul. 20, pp. 87, charts 20*).—It is stated that the purpose of this bulletin is "to present the latest phases of the science of meteorology as regards practical forecasting of weather conditions." It contains chapters on the construction of daily weather maps; weather forecasting by months, including discussions of the origin and tracks of storms, frost formation, cold waves, droughts, and other meteorological phenomena; weather conditions at Washington, D. C., for 26 years (1871–'96); circulation of the atmosphere in the upper levels—the international cloud observations; description of the solar magnetic period of 26.68 days and its relation to the formation of storms in the Northwest—definitions of the terrestrial magnetic elements—solar magnetism and its connection with the weather; and practical and long-range weather forecasting. The charts show the tracks of storms during each month of the year and some of the relations existing between solar magnetism and other meteorological elements.

The principal features of the bulletin are summarized as follows:

"(1) The general circulation of the atmosphere has a downward component near the poles where the northward upper stratum returns into the lower southward current, its power consisting in slowing down the rapid eastward drift by diverting it into descending anticyclonic vortices; (2) these are localized upon the continents, chiefly in winter, by reason of the action of the land areas being colder than the oceans, wherefore highs tend to form in western Canada especially during that season; (3) the entrance of the earth into longitudes of the sun having a stronger magnetic field lowers the temperature in this region, and thus assists the tendency to form high areas at definite dates in the general subpolar circulation, it being more pronounced on the North American continent than elsewhere in the same high latitudes by reason of the presence of the magnetic pole near that place; (4) these highs drift southward and eastward within the great eastward upper current, being still fed by the general circulation, which itself is sustained from the tropical zones and continues to discharge downward into the highs by means of an anticyclonic stationary system of streams; (5) between successive highs is formed a low with cyclonic circulation, which, under hydrostatic pressure, aided by convectional vertical components of warmer air, drives the air in stream lines back into the upper strata, there to be aimlessly destroyed in the rapid eastward currents; (6) the convective action in cyclones derived from local temperature and the latent heat of condensation of vapor in precipitation is an important incident, assisting gyratory vortex action, but after all only a secondary phenomenon; (7) this view admits the validity of Ferrel's analytical solution (also Overbeck's) of the general circulation of the atmosphere, but concludes that it is not strictly applicable to the local mid-latitude cyclones; that the general cyclone of the poles and the local cyclone with anticyclone surrounding it are not so parallel in theory as was supposed in the formulæ. On the other hand, the lows are not eddies in the upper currents, but more properly the highs are the the eddies; actually they are stationary downward circulations in deflecting the direction of the upper into the lower strata, and the lows are secondary effects derived from these under the impelling forces of gravity and hydrostatic pressure. This explanation gives to the entire machinery of the atmosphere, it is believed, a logical and harmonious operation, and it certainly avoids some of the difficulties that are now felt by meteorologists."

Experiments on the prevention of night frosts, F. H. KING (*Wisconsin Sta. Rpt. 1896, pp. 207–209, fig. 2*).—In continuation and extension of the experiments of the previous year with torches,[1] a plat of rape was furrow-irrigated on the night of September 27, when the temperature early in the evening had been as low as 40° F. The temperature of the lake water as it reached the field was 56° F.; at the lower end of the rows it had fallen to 54° F.

"Not only did frost form after the water was brought to the areas, but some of the rape leaves became stiff with streams of water flowing both sides of the row. . . . Close to the water, however, the leaves did not become so rigid as to break in the hand, while at a distance from the water they did."

[1] Wisconsin Sta. Rpt. 1895, p. 253 (E. S. R., 8, p. 671).

Meteorological records, DUKE OF BEDFORD and S. U. PICKERING (*Rpt. Woburn Expt. Fruit Farm, 1897, pp. 175–180*).—Monthly summaries of observations on temperature, radiation, humidity, and rainfall for 18 months beginning July, 1895, are reported.

Meteorology, P. BONAME (*Rap. An. Sta. Agron.* [*Mauritius*], *1896, pp. 1–7*).—Monthly summaries of observations during 1896 on temperature, pressure, humidity, and precipitation.

Rainfall of the United States, with annual, seasonal, and other charts, A. J. HENRY (*U. S. Dept. Agr., Weather Bureau Bul. D, pp. 58, pls. 3, charts 11*).—"The facts and conclusions presented in this report have been drawn from the longest and at the same time the most reliable rainfall registers in the United States; the averages have been compiled to the end of 1896." The rainfall of the crop-growing season is treated separately and the area under discussion has been divided into rainfall districts according to their natural boundaries.

Amount and composition of rainfall, 1895–'96 (*Rpt. Expt. Fields Dodds Reform.* [*Barbados*], *1896, p. 1*).—The total amount of rainfall and the parts per million of chlorin, total nitrogen, nitrogen as ammonia, and nitrogen as nitrates in rainfall collected from November, 1894, to March, 1896, are tabulated.

A new form of evaporimeter, DUKE OF BEDFORD and S. U. PICKERING (*Rpt. Woburn Expt. Fruit Farm, 1897, pp. 168–174, fig. 1*).—"In devising a new form of instrument it has been our object to adopt a form in which the surface from which evaporation occurs shall be as nearly as possible analogous in position to the leaves of a tree.

"The moist surface consists of a sheet of tough blotting paper, filter-paper, or linen, measuring 100 by 50 mm. (about 4 by 2 in.), held vertically by means of a movable copper frame in a vessel of water fitted with a graduated side tube. The sheet of paper or linen ends in a tongue, which dips into the water, and is thus kept moist. The graduations are such that they give the number of units of volume evaporated per unit area of paper exposed. Thus, a fall of 0.24 shows that 0.24 cc. or cubic inches has evaporated from each square centimeter or square inch of the paper."

Tests of the accuracy of this apparatus using different kinds of paper are reported.

The equations of hydrodynamics, J. COTTIER (*U. S. Dept. Agr., Weather Bureau, Doc. 130, pp. 8, figs. 3*).—A discussion of equations of hydrodynamics applicable to problems connected with the movements of the earth's atmosphere, reprinted from from the *Monthly Weather Review* for July, 1897.

A study of the normal variation in the electric field with the elevation, in the upper regions of the atmosphere, G. LE CADET (*Compt. Rend. Acad. Sci. Paris., 125* (*1897*), *No. 14, pp. 494–496*).

Recent studies on tempests, cyclones, or tornadoes, H. FAYE (*Paris: Gauthier-Villars, 1897, pp. 142*).

The extreme temperatures of Finland (*Rev. Sci.* [*Paris*], *4. ser., 8* (*1897*), *No. 17, p. 535*).

The story of the atmosphere, D. ARCHIBALD (*New York: D. Appleton & Co., 1897, pp. 194, figs. 43*).—This is one of The Library of Useful Stories issued by these publishers, which is "a series of little books dealing with various branches of useful knowledge and treating each subject in clear concise language as free as possible from technical words and phrases, by writers of authority." The present volume treats of the main features of the conditions which prevail in the atmosphere. The subject of weather and the description of instruments are omitted and climate is only briefly touched upon. A chapter is devoted to the subject of flight.

WATER—SOILS.

Influence of subsoiling on soil moisture, F. H. KING (*Wisconsin Sta. Rpt. 1896, pp. 166–177, fig. 1*).—Four experiments are reported. In the first, October 22, 1895, a plat of "medium clay loam shading into sand at a depth of 3 or 4 ft.," 27 ft. wide and 142 ft. long, was plowed to a depth of 6 in. and a strip 9 ft. wide through its center was subsoiled, by spading to a depth of 18 in.

Before plowing and on April 8, 1896, the soil remaining undisturbed in the interim, samples of the soil were taken to a depth of 4 ft. at 6 equally distant points along 3 lines 9 ft. apart, and the amount of moisture the soil contained determined. There was found to be little difference (0.34 lb. in columns of soil 1 ft. square and 4 ft. deep) in the total amounts of water in the treated and untreated soils, but the surface foot of the unsubsoiled area contained 1.94 lbs. more water per cubic foot than that which had been subsoiled. Examinations of the same soils at later dates, April 16 and May 5, showed "that the differences existing in the amount and distribution of water in the subsoiled and not subsoiled plats became less each time the samples were taken, so much so indeed, that on May 5 there was in reality very little difference between them."

In the second experiment the attempt was made to determine the effect of subsoiling upon the water content of soil from which evaporation was prevented.

"The soil was completely removed from an area 6 by 6 ft. to a depth of 8 in. and the subsoil spaded to a depth of 13 in. more, and after this had been done the surface soil was returned to its place. There was no attempt to firm the soil except to smooth the surface by the weight of a man standing on a 12-inch plank after the soil was all in place.

"Samples of soil were now taken to a depth of 5 ft. in 1-foot sections and each sample was a composite of 5. Samples were also taken from a similar closely adjacent area which had not been subsoiled.

"The holes where the samples had been taken were then closed at the top with wooden plugs and then water was slowly applied to the 2 surfaces until 254.41 lbs. or 1.06 in. had been added.

"To prevent all evaporation from the surfaces they were each covered with a zinc-lined wooden tray turned down over them and the soil banked up around the edges. This work was completed on June 11, and on June 15 the trays were removed and samples of soil again taken to a depth of 5 ft."

The results show that the subsoiled plat not only retained all of the 254 lbs. of water added, but acquired 14 lbs. additional through upward and lateral capillarity during 4 days. The plat not subsoiled, on the other hand, lost 126 lbs. of water in the same time, or nearly half of that applied.

The third experiment was a repetition of the second, except that no water was applied. The results show little change in the water content of the subsoiled plat. In the plat not subsoiled moisture accumulated in the upper 3 ft., while the fourth and fifth feet became drier.

"If we express the changes in the water content in pounds which the percentages indicate then the upper 3 ft. of the not subsoiled area gained during the 6 days 129.69 lbs., while the lower 2 ft. lost 53.52 lbs. . . . On the other hand, the subsoiled area in its upper 3 ft. lost 11.14 lbs., while the lower 2 ft. gained 39.38 lbs., making the absolute gain to the area only 28.24 lbs."

In the fourth experiment 2 plats which had been subsoiled in the latter part of June "were allowed to stand until September 9 unprotected and undisturbed in any way, except that weeds were kept from growing upon them by shaving them off with a hoe. Samples of soil were taken [to the depth of 5 ft.] at 4 places on each of the subsoiled areas and at 5 places on the intervening not subsoiled area. . . .

"On the subsoiled ground there was found more water in the second, third, and fourth feet than was found in the soil not so treated, but the surface foot was markedly drier."

A general explanation of the effects of subsoiling on soil moisture is given.

An electrical method of determining the moisture content, temperature, and soluble salt content of soils, M. WHITNEY, F. D. GARDNER, L. J. BRIGGS, and T. H. MEANS (*U. S. Dept. Agr., Division of Soils Buls. 6, pp. 26, figs. 6; 7, pp. 15, fig. 1; 8, pp. 30, figs. 6*).—The method proposed for determining moisture is based upon the fact that the electrical conductivity of a soil depends principally upon three factors.

"[These factors] which as a rule are constantly changing, are the temperature the water, and the soluble salt; in other words, the amount and concentration of the salt solution and the temperature. Therefore, to determine the temperature of the soil, the water content, or the amount of salt dissolved in the water, it is necessary to know two of these three values at the time of observation in order to establish the other.

"Advantage was taken of the influence of temperature on the resistance of solutions to construct a temperature cell, which is essentially a salt solution inclosed in a hermetically sealed glass tube, in which neither the salt nor the water can change. The solution used has the same temperature coefficient as the soil, so that the variation in the electrical resistance of this cell when buried in the soil, will give the temperature of the soil; or, if it is used as one arm of the Wheatstone bridge in place of one of the standard comparison coils, it will eliminate the temperature effect altogether in measuring the electrical resistance of the soil. The same cell, therefore, will thus answer a double purpose.

"For the measurement of the electrical resistance of the soil the Wheatstone bridge method is used with the alternating current and a telephone to indicate when a balance has been obtained."

The apparatus devised for this purpose is described in detail and the results of observations with the instrument in the field are reported.

The determination of temperature and soluble salt content of soils by modifications of the same method is also explained.

"It was desired to perfect a method which would indicate the variations in the soluble salt content in the undisturbed soil of the field, but this has not yet been accomplished, although there is reason to believe it can eventually be done. A very simple and delicate method has, however, been devised for determining the soluble salt content of soils in samples taken from the field. The method consists essentially of mixing a known quantity of soil with a known proportion of pure water and determining the specific resistance. Then an equal weight of the same soil is mixed with a quantity of a dilute salt solution equal in volume to the pure water which had been mixed with the first quantity of soil. The specific resistance is again determined. This will be lower than before. The amount of salt added to the soil in solution is accurately known, as well as the effect it had on the resistance. From this data the quantity of salt originally present in the soil can readily be calculated in terms of the salt solution used."

Tables are given for converting electrical resistances into conductivity, for calibrating temperature cells, and for reducing the electrical resistance to a uniform temperature of 60° F.

On the denitrification processes, T. PFEIFFER (*Chem. Ztg., 21 (1897), No. 81, p. 841*).—The author studied various forms of denitrifying organisms isolated from horse manure and soil. A new form of apparatus was used for studying the gas evolution of these organisms in different nutrient solutions (Giltay's and nitrate-bouillon). The activity of all forms ceased in an atmosphere of carbon dioxid. In one culture of *Bacillus denitrificans*, admitting pure oxygen or air did not effect denitrification. This is in direct contradiction to the observations of Ehrenberg and Stutzer.

The influence of caustic lime and marl on the denitrification process was studied both in culture media and in experiments with oats in pots containing 27 kg. of soil mixed with 500 gm. of fresh horse manure. The results were favorable to the use of these substances.

The author concludes from his studies that the danger of loss by denitrification is not so great as it was formerly supposed to be.

Analyses of Wisconsin soils, F. W. WOLL (*Wisconsin Sta. Rpt. 1896, pp. 303–305*).—Analyses of 14 samples of soils collected in the course of an agricultural survey of northern Wisconsin are reported. The averages of all available analyses of soils of the same type in Wisconsin, Michigan, and Minnesota are given in the following table:

Average analyses of different types of Michigan, Minnesota, and Wisconsin soils.

	No. of analyses.	Lime.	Phosphoric acid.	Potash.	Nitrogen.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Prairie soils	17	0.93	0.24	0.39	0.26
Clayey soils	7	1.46	.19	.67	.06
Loamy soils	8	.70	.21	.48	.16
Dark sandy soils (potato soils)	10	.49	.15	.52	.08
Sandy soils	15	.37	.09	.57	.06
Peaty soils	8	3.45	.46	.22	1.71

The treatment of swamp or humus soils, F. H. KING (*Wisconsin Sta. Rpt. 1896, pp. 178–188, figs. 3*).—There are large areas of swamp lands in Wisconsin, some of which are being drained. It has been observed in reclaiming these lands that certain spots, even on land which is apparently in good condition, remain unproductive. The soil of these spots is generally of a close, compact character. Analyses showed that the amount of moisture present in them was not excessive.

Experiments were made on reclaimed marsh land of this character at the station with a view to discovering the cause of its unproductiveness. It was believed that the application of lime would improve its texture, but a heavy dressing of this substance, although increasing somewhat the water content of the surface foot of soil, at the expense of the lower layers, and the yield of corn, was not of marked benefit. Barnyard manure at the rate of 34 loads per acre increased the yield nearly 2 tons of dry matter per acre. It is suggested that the beneficial effect of the manure was due to the available nitrogen which it supplied.

Moisture determinations in unfertilized plats and in those fertilized with barnyard manure, basic slag, marl, kainit, potassium sulphate and chlorid, bone meal, and superphosphate, show that—

"The average percentage of moisture in the surface foot of ground to which fertilizers had been applied was 1.35 per cent less than the surface foot where the fertilizers were not applied and that the second foot is just a trifle drier also. This is in the same direction as that found for the lime experiment. But here again as in that case it must be observed the yield of dry matter is greater on the fertilized ground than it is on the ground not so treated, and in the author's judgment this drying out must be attributed to the larger plant growth stimulated by better feeding rather than to the physical effect of the fertilizers. . . .

"While there was practically no difference in the yield of dry matter from the plats treated with phosphoric acid fertilizers and their check plats there is a larger difference in the soil moisture of the surface foot than is shown on the potash plats where the yield of dry matter is 1,031 lbs. per acre greater. While this difference tends to establish a physical effect of the fertilizers used the author does not feel that the observations are sufficiently numerous to prove that the case is not merely one of the coincidences which so often occur.

"The data further suggest that while marl and the phosphoric acid fertilizers have not materially increased the yield, the potash fertilizers have, and hence that our black marsh soils may need potash as well as nitric nitrogen.

"The barnyard manure produced a much larger increase of yield than did any of the other fertilizers, which may be due to the fact that it could give both the potash and the nitric nitrogen."

On the determination of the organic matter in water by means of potassium permanganate, F. Marboutin and M. Franck (*Bul. Soc. Chim. Paris, 3. ser., 17 (1897), No. 18–19, pp. 888–890*).—A comparison of the Albert-Lévy and the Forchammer-Frankland method on 11 samples of river water from the region of Paris. The results by the former method were about twice as high as those yielded by the latter.

Physico-geographical regions of European Russia, G. I. Tanfilyev (*Trudi Imper. Volnaro Econ. Obsh., 1896, I, pp. 1–31*).—The different regions are classified according to soils and plants and discussed in some detail. Russia is thus divided into 4 grand divisions: (1) Northern Russia or the region of the fir; (2) Southern Russia or the region of the steppes; (3) Aralo-Caspian region of alkali soils, and (4) southern coast of the Crimea. Particular attention is given to the black soils, the steppes, and the alkali soils.—P. FIREMAN.

On the soils of the Vistula region, N. M. Sibirzev (*Trudi Imper. Volnaro Econ. Obsh., 1896, I, pp. 54–63*).

On the chernozem (black soil) of the Vladimir government, G. I. Tanfilyev (*Trudi Imper. Volnaro Econ. Obsh., 1896, I, pp. 47–53*).

Investigations on the effect on the physical properties of moor soils of mixing and covering with sand, E. Wollny (*Forsch. Agr. Phys. [Wollny], 20 (1897), No. 1, pp. 187–212*).

On the self-purification of soils, G. RIEGLER (*Arch. Hyg., 30 (1897), p. 80; abs. in Chem. Ztg., 21 (1897), No. 83, Repert., p. 223*).

The importance of chemical soil analysis in the selection of farms and the Kamerun soils, F. WOHLTMANN ET AL (*Ztschr. Trop. Landw., 1 (1897), No. 3, pp. 51–55, fig. 1*).—This article refers to methods and results reported elsewhere,[1] and discusses the value of chemical analysis in selecting soils for agricultural purposes, especially as illustrated in the case of the Kamerun and other East African soils examined by the authors.

The results of chemical examination of German East African soils, F. WOHLTMANN ET AL (*Ztschr. Trop. Landw., 1 (1897), No. 6, pp. 129–133, tab. 1*).—The results of examination of a large number of soils of this region which have been published elsewhere[1] are here summarized and discussed. The analyses show that the soils of the Kamerun Mountains are almost uniformly rich in fertilizing constituents, although analyses of soils from other regions in East Africa show that the soils are generally poor in plant food. It is evident that great care must be exercised in the selection of soils for agricultural purposes in this region.

The object and advantages of deep culture, TANCRÉ (*Landw. Wchnbl. Schleswig-Holstein, 47 (1897), No. 43, pp. 619–621*).

FERTILIZERS.

Commercial fertilizers (*Connecticut State Sta. Rpt. 1896, pp. 81–177*).—A statement of the amount of fertilizers used in Connecticut in 1896; an abstract of the State laws relating to fertilizers; a list of manufacturers complying with the fertilizer law; notes on the sampling and collecting of fertilizers; explanations concerning the analysis and valuation of fertilizers; a review of the fertilizer market for the year ending November 1, 1896, by E. H. Jenkins; notes on the use of tables of analyses of fertilizers and fertilizer chemicals, by E. H. Jenkins;[2] and tabulated analyses and valuations of 492 samples of fertilizing materials classified as follows: (1) raw materials containing nitrogen as the principal ingredient—nitrate of soda, sulphate of ammonia, dried blood, horn and hoof, cotton-seed meal, linseed meal, castor pomace, mustard-seed cake, and preparations of leather; (2) raw materials containing phosphoric acid as the principal ingredient—odorless phosphate, dissolved boneblack, and dissolved rock phosphate; (3) raw materials containing potash as the principal ingredient—high grade sulphate of potash, double sulphate of potash and magnesium, phosphate of potash, muriate of potash, and "potash salts;" (4) raw materials containing nitrogen and phosphoric acid—bone manures, tankage, and fish; (5) mixed fertilizers—bone and potash, nitrogenous superphosphates, special manures, and home mixtures; (6) miscellaneous fertilizers and manures—cotton-hull ashes, wood ashes, limekiln ashes, tobacco stems and dust, muck, peas, and beans.

The results of inspection show the percentage of nitrogen in nitrate of soda (12 samples) ranged from 15.53 to 16.21; the price per pound of

[1] Jour. Landw., 44 (1896), p. 211 (E. S. R., 8, p. 573).

[2] See also Connecticut State Sta. Bul. 122 (E. S. R., 8, p. 122).

nitrogen varied from 12.7 to 15 cts.; the cost per pound of nitrogen in the 2 samples of sulphate of ammonia analyzed was 15.5 and 16.8 cts. The nitrogen in decorticated cotton-seed meal (43 samples) ranged from 8.17 to 6.28 per cent. the average being 7.05 per cent. The retail cash cost per pound of nitrogen varied from 11.2 to 15.5 cts., with an average of 12.7 cts. The nitrogen of a sample of unhulled dark meal cost about 3.5 cts. per pound more than that of good quality yellow meal. Cottonseed meal of good quality is therefore one of the cheapest sources of available nitrogen, but "it is a waste of money to buy low grade rather than high grade meal for use as a fertilizer at present prices." In 8 samples of linseed meal examined, the average cost of nitrogen per pound was 13 cts.; in 4 samples of castor pomace it ranged from 15.6 to 20.6 cts.; the latter is therefore a very expensive form of nitrogen at present prices. The price of available phosphoric acid in 5 samples of dissolved boneblack and 6 samples of dissolved rock phosphate examined varied from 5.9 to 7.6 cts. per pound. "In mixed car lots it has been bought for a little over 3 cts. per pound."

The retail cash price of potash as high-grade sulphate (6 samples) ranged from 4.9 to 5.2 cts. per pound; as double sulphate (7 samples) from 4.9 to 6.3 cts. per pound; as muriate (8 samples) from 3.9 to 4.4 cts. per pound.

"Of the 88 analyses of nitrogenous superphosphates [reported], 27 are below the maker's minimum guarantee in respect of one ingredient and 5 in respect of two ingredients. Thus 36 per cent, or more than one-third of these fertilizers, do not fulfill the manufacturer's guarantees. . . . The average cost of the nitrogenous superphosphates is $31.56 per ton. The average valuation is $21.18, and the percentage difference 49. . . .

"Of the 83 brands of special manures here reported 22 are below the manufacturer's guarantee in respect of one ingredient and 5 in respect of two ingredients, so that nearly one-third of the whole number do not fulfill the manufacturer's claims. . . . The average cost of the 83 special manures was $36.19 per ton. The average valuation was $25.64. The difference, $10.55, is equivalent to a 'percentage difference' of 41.1. . . .

"The average cost of 8 samples of home mixtures was $27.66, or, adding $2 per ton for mixing, $29.66. The average valuation of the same was $26.05, and the percentage difference between cost and valuation 13.9."

In 22 samples of wood ashes examined during the year the potash soluble in water varied from 3 to 6.7 per cent; the phosphoric acid from 1 to 2.6 per cent. In 21 samples, the lime ranged from 24.5 to 40.8 per cent. The average composition and cost of the wood ashes examined in 1896 were approximately as follows: Potash soluble in water, 5.5 per cent; phosphoric acid, 1.5 per cent; lime, 32.5 per cent; sand and soil, 11 per cent; charcoal, 2.5 per cent; cost, $10.36. In 31 analyses of cotton-hull ashes, the potash soluble in water varied from 15.4 to 30.64 per cent, and the phosphoric acid from 5.96 to 11.68 per cent. The averages of these 2 ingredients were 23.1 and 9.7 per cent, respectively.

Potash and its function in agriculture, H. W. WILEY (*U. S. Dept. Agr. Yearbook 1896, pp. 107–136*).—A popular discussion of the origin, distribution, loss, and solubility of potash in soils; the draft of different crops on soil potash; the source, form, and consumption of potash fertilizers; and the application and effects of potash salts.

It is stated, among other things, that about 25 per cent of the potash of the original rocks from which soils are derived is lost by lixiviation, that which remains being quite equally distributed in the soil and subsoil. "A fertile virgin soil contains about 2 per cent of total potash, or about 70,000 lbs. per acre taken to the depth of one foot;" but even in such soils a part of the potash is held with such tenacity as to render it practically unavailable to plants.

The amounts of potash removed by different crops vary greatly, beets probably standing first, followed in order by hay, cereals, and cotton. Tobacco contains a higher percentage of potash than any other common crop; then follow forage beets, potatoes, sugar beets, clover hay, beans, and cereals in the order named.

It is stated that "a soil which yields about 0.01 per cent of potash to a 1 per cent citric-acid solution and contains about 0.30 per cent soluble in hydrochloric acid does not usually need a potash fertilizer. . . . Recovered marsh or swamp lands and lands containing large quantities of sand need, almost universally, potash fertilizer. The percentage of potash in soils usually rises with their content of clay. . . .

"Lime is an important adjunct to potash fertilization, and, as a rule, should be added to a soil in large quantities wherever potash is applied."

Many of the potash salts are very hygroscopic, and when applied to heavy, compact soils may cause puddling, which renders the soil impervious to water and impenetrable by the roots of plants. On the other hand, on soils which are not easily puddled potash salts may be beneficial in dry periods by reason of this power of attracting and holding moisture. The same property may make crude potash salts of use in protecting the crop from frosts by checking evaporation.

Large applications of potash may retard the process of nitrification. On the other hand, it is claimed that the liberal application of crude potash salts, especially kainit, acts to a certain extent as an insecticide or a preventive of disease.

Experiments on the availability of fertilizer nitrogen, S. W. JOHNSON, E. H. JENKINS, and W. E. BRITTON (*Connecticut State Sta. Rpt. 1896, pp. 178–204*).—This is a continuation of the work of previous years (E. S. R., 8, p. 387), the same apparatus and methods being used as in earlier experiments. The pots as left at the end of the experiments in 1895 were used, the undecomposed roots of the previous crop being pulverized, and the following basal fertilizer added: 25 gm. sodium chlorid, 1 gm. magnesium carbonate, 8 gm. calcium carbonate, 5 gm. potassium phosphate, and 1 gm. potassium sulphate. The crop grown was corn. The nitrogenous materials used "were in each case a part of the same stock from which last year's tests were made."

The details of fertilizers applied and the weight and nitrogen content of the crop produced during 1894, 1895, and 1896 are given in full in a table. The principal results are summarized as follows:

Availability of different forms of nitrogen, taking that of nitrate of soda as 100.

	Experiments of 1894.	Average of experiments of 1894 and 1895.	Average of experiments of 1894, 1895, and 1896.
Nitrate of soda	100	100	100
Castor pomace, A	90	83	77
Cotton-seed meal	87	79	74
Castor pomace, B	73	73	70
Linseed meal	74	72	70
Dried blood	79	72	68
Dried fish	69	69	69
Dissolved leather	76	70	65
Horn and hoof	77	67	67
Tankage	73	64	61
Steamed leather	8	10	13
Roasted leather	9	10	9
Raw leather	2	2	2

"The availability of the nitrogen of roasted, steamed, and raw leather, while not alike in the 3 years, is so much lower than that of any other materials tested as to demonstrate that the nitrogen in them is comparatively inert and of little effect unless applied in large quantities.

"The experiments also demonstrate that leather may be dissolved in oil of vitriol so as to make its nitrogen nearly as available to the maize and oat crops as that of tankage. Samples of roasted leather, steamed leather, and dissolved leather were prepared each year from a common stock of raw leather, and slight differences in their preparation might explain the differences of availability observed in different years.

"Of the 9 materials tested, other than leather, tankage certainly has the lowest nitrogen availability, ranking seventh, ninth, and ninth in the 3 years' tests.

"Regarding the nitrogen availability of the other organic matters, the experiments are not altogether conclusive."

As in previous years, the amount of water supplied to different series of pots was varied. The largest assimilation of nitrogen took place in the pots whose water supply was maintained between 40 and 80 per cent of the water-holding capacity of the soil.

In cooperation with the reporter on nitrogen for the Association of Official Agricultural Chemists, a comparison was made of nitrogen availability determined by vegetation experiments and by treatment with chemical reagents (pepsin and potassium permanganate). The materials tested were blood, tankage, horn and hoof, raw leather, and a commercial fertilizer. The crop used in the vegetation experiments was corn. The highest percentage of availability of nitrogen (47) as determined by corn cultures was found in dried blood. The percentage of digestibility of the nitrogen of the same substance in pepsin solution was 93.

"If now we call its percentage digestibility 47, to agree with the percentage availability, and reduce the other figures for pepsin digestibility in the same ratio, we have a set of numbers which show how the relative solubility and digestibility compare with relative availability, as fixed by maize cultures."

Relative availability and solubility of different nitrogenous fertilizers.

	Availability by maize cultures.	Digestibility in pepsin-hydrochloric acid.	Solubility in potassium permanganate solution.	
			Acid.	Alkaline.
Blood	47	47	47	47
Tankage	45	39	45	43
Horn and hoof	43	28	42	52
Leather	3	8	14	25
Source of nitrogen unknown (fertilizer)	30	27	34	33

"In these cases the treatment with an acid solution of potassium permanganate has given the closest approximation to the results of maize cultures."

A series of pot cultures with oats and corn to determine the availability of nitrogen in bone of different degrees of fineness are also reported. The pots used were of stout galvanized iron 9.75 in. in diameter and 20 in. long, open at both ends. These were sunk in the soil to within 2 in. of their upper edges. The pots were filled with soil from the station grounds which had not been cultivated for 14 years or manured for 9 years. The soil of each pot received 6.5 gm. acid phosphate (14.28 per cent of available phosphoric acid), 10 gm. precipitated calcium carbonate, and 5 gm. of a mixture of sulphate of potash, double sulphate of potash and magnesium, and muriate of potash containing 47.38 per cent potash. A preliminary crop of oats was grown in the different pots in order to test the uniformity of the soil and to determine the amount of available nitrogen present.

In the succeeding experiment with corn 5 grades of bone were tested: (1) Bone which passed bolting cloth with holes $\frac{1}{150}$ in. in diameter and contained 3.38 per cent of nitrogen; (2) that which passed circular holes between $\frac{1}{50}$ and $\frac{1}{150}$ in. in diameter and contained 3.90 per cent nitrogen; (3) that which passed circular holes between $\frac{1}{25}$ and $\frac{1}{50}$ in. in diameter and contained 4.07 per cent of nitrogen; (4) that which passed circular holes between $\frac{1}{12}$ and $\frac{1}{25}$ in. in diameter and contained 4.05 per cent nitrogen; (5) that which passed circular holes between $\frac{1}{6}$ and $\frac{1}{12}$ in. in diameter and contained 4.08 per cent nitrogen.

Comparative tests were also made of nitrate of soda and cotton-seed meal as sources of nitrogen. The results may be briefly summarized as follows:

Availability of bone nitrogen.

	Maximum.	Minimum.	Average.
	Per cent.	*Per cent.*	*Per cent.*
Grade 1, passed fine bolting cloth	22.7	0.0	9.7
Grade 2, smaller than $\frac{1}{50}$ in	7.5	.2	3.0
Grade 3, $\frac{1}{50}$ to $\frac{1}{25}$ in	9.2	.0	4.2
Grade 4, $\frac{1}{25}$ to $\frac{1}{12}$ in	5.4	.0	1.9
Grade 5, $\frac{1}{12}$ to $\frac{1}{6}$ in	7.5	.0	2.7

"These experiments of a single year have shown that, under the conditions specified, fine bone flour prepared from the hardest bones (selected raw knuckle bones free from all tendon, cartilage, etc.) was about one-third as efficient as a source of nitrogen to the maize crop as cotton-seed meal, and that the coarser grades of bone supplied but very little nitrogen to the growing crop."

On the denitrification processes, A. EHRENBERG (*Chem. Ztg., 21 (1897), No. 88, p. 922*).—Attention is called to the fact that the author's results referred to above by Pfeiffer (see p. 536) were obtained in studies of putrefaction where a variety of organisms were present, which may account for the different behavior in the presence of oxygen and air.

Fertilizing value of "lake mud," F. W. WOLL (*Wisconsin Sta. Rpt. 1896, pp. 307, 308*).—One sample was examined with the following result: Ash 26.88, nitrogen 3.56, phosphoric acid 0.28, and potash 0.15 per cent. The fertilizing value of such mud is briefly discussed.

Marls of Wisconsin (*Wisconsin Sta. Rpt. 1896, pp. 295–302*).—A reprint of Bulletin 51 of the station (E. S. R., 8, p. 208).

The excessive use of manure, G. PATUREL (*Ann. Agron., 23 (1897), No. 8, pp. 369–375*).—The article reports and briefly discusses the results of examinations of spots of a soil on which heaps of manure were allowed to lie during a wet period before seeding and which were thus rendered unproductive for beets. The soil was found to be impregnated with ammonium carbonate. This, however, soon nitrified and the poisonous properties of the soil were thus removed. The danger of loss by leaching of manure and of nitrates in the soil is explained.

The maintenance of soil fertility: Commercial fertilizers, F. W. WOLL (*Wisconsin Sta. Rpt. 1896, pp. 260–294, 321, 322, chart 1*).—This is a reprint of matter already published in Bulletins 47 and 49 of the station (E. S. R., 8, pp. 115, 212). A colored chart shows the fertilizing constituents in the more important feeding stuffs.

An examination of samples of Thomas phosphate, M. MAERCKER (*Landw. Vers. Stat., 49 (1897), No. 3, pp. 231–238*).—The author reports results obtained by eight of the German experiment stations on samples of Thomas phosphate, by the Wagner molybdate method, the Böttcher citrate method, and the potassium citrate method of Mach-Passon. The Wagner and Böttcher methods gave uniformly concordant results, while the Mach-Passon method gave low results in every case, the difference varying from 0.10 per cent to 0.75 per cent. A discontinuance of the further use of the last was recommended.—J. P. STREET.

Needed reforms in fertilizer inspection (*U. S. Dept. Agr., Division of Chemistry Circ. 3, p. 3*).—This is a report of a conference at New York City, May 18, 1897, between the committee appointed at the preliminary meeting of Official Inspectors of Fertilizers at New Haven, Connecticut, March 9, 1897, and a committee of the Association of Manufacturers and Dealers in Fertilizers in the United States. The object of this conference was to discuss uniform methods of fertilizer control and to take steps to secure such methods.

The Wisconsin fertilizer law (*Wisconsin Sta. Rpt. 1896, pp. 321, 322*).—Text of the State fertilizer law of 1895.

FIELD CROPS.

Some results of the experiments with tobacco fertilizers for the five years 1892-'96, E. H. JENKINS (*Connecticut State Sta. Rpt. 1896, pp. 310–333*).—This is a report on some of the results obtained from experiments begun in 1892 and of which the crop of 1896 completed the series. Samples of the last crop were cased down for fermentation at the time of making this report, hence the final discussion of the quality of the tobacco from the different plats is reserved until later. The author here compares the average yields of the various plats for the entire period and discusses those qualities of the crop determined in the unfermented leaves. Reports on every crop have been given in former publications (see p. 549).

On 6 plats the effect of the quantity of nitrogen was determined. The plats were annually treated with 340 lbs. of potash and from 140 to 190 lbs. of phosphoric acid per acre, chiefly in the form of cotton-hull ashes, in addition to the different amounts of nitrogen given in the following table, which contains the statistics of the crops for the entire period:

Effects of different amounts of nitrogen—Yearly averages.

Plat.	Source of nitrogen.	Nitrogen per acre.	Yield of leaf tobacco per acre.				Number of pole-cured leaves to pound.		Number of seconds holds fire.	
			Total.	Long wrappers.	Short wrappers.	Percentage of wrappers.	Long wrappers.	Short wrappers.	Long wrappers.	Short wrappers.
		Lbs.	*Lbs.*	*Lbs.*	*Lbs.*					
A	Cotton-seed meal	105	1,615	740	245	61	66	89	14	15
E	Castor pomace	105	1,760	803	203	60	59	84	10	15
C	Cotton-seed meal	175	1,673	795	276	64	61	85	12	14
G	Castor pomace	175	1,700	769	267	61	62	81	10	13
D	Cotton-seed meal	210	1,839	957	268	67	60	85	10	15
H	Castor pomace	210	1,863	996	271	68	60	84	10	12

The application of 210 lbs. of nitrogen per acre, either in the form of castor pomace or cotton-seed meal, gave a larger crop each year and a greater percentage of wrapper leaf, which is the most valuable part of the crop, than the application of 105 or 175 lbs. of nitrogen.

"The plat having 210 lbs. of nitrogen in the form of cotton-seed meal produced 224 lbs. more crop than the one having 105 lbs. of nitrogen. At 12½ cts. per pound this gain amounts to $28.06 per acre. The increased amount of fertilizer, 1,500 lbs., at $25 per ton, costs $18.75; so that it has paid to use the larger quantity of fertilizer, provided the quality of the leaf was not damaged by it. . . . The tobacco from plats having the largest quantity of nitrogen (cotton-seed meal or castor pomace) has in the average of four years' crop been of better quality than that from plats with smaller amounts of nitrogen."

In connection with these experiments a comparison of cotton-seed meal and castor pomace as a tobacco fertilizer was made. The castor pomace produced on an average for the 5 years 111 lbs. of tobacco more per acre than cotton-seed meal. The author figures this increase to be worth $13.87, and states that as 210 lbs. of fertilizer-nitrogen in the form of castor pomace costs $8.40 more than in the form of cotton-seed meal, the net annual profit is not more than $5.47 per acre, provided the quality of the crop is the same. From the relative rank of the various crops he concludes that the average quality of the tobacco raised with cotton-seed meal has been somewhat better than that of tobacco raised with castor pomace.

An experiment was conducted to observe the effect of nitrate of soda applied during the growing season. The same quantities of cotton-hull ashes and of nitrogen were applied for 5 years. Plat H received all its nitrogen (210 lbs. per acre) in the form of castor pomace, while plats I and J received only 105 lbs. in the same form and the rest in the form of nitrate of soda—plat J in one application and plat I in 2 applications. The results are given in the following table:

Effect of nitrate of soda added during the growing season.

Plat.	Source of nitrogen.	Nitrogen per acre.	Yield of leaf tobacco per acre.				Number of pole-cured leaves to pound.		Number of seconds holds fire.	
			Total.	Long wrappers.	Short wrappers.	Percentage of wrappers.	Long wrappers.	Short wrappers.	Long wrappers.	Short wrappers.
		Lbs.	*Lbs.*	*Lbs.*	*Lbs.*					
H	Castor pomace	210	1,863	996	271	68	60	84	10	12
I	Castor pomace and nitrate of soda	210	1,860	973	273	67	63	83	9	15
J	do	210	1,932	1,040	293	69	65	80	10	16

"The average yield of tobacco, as well as the yield of wrapper leaves, was decidedly larger on plat J, which received part of its nitrogen in a single application of nitrate of soda after the crop was nearly half grown, than on either of the other plats; the individual leaves were no heavier, nor was there any perceptible difference in fire-holding capacity. The quality of the wrapper leaf must determine whether the practice is a profitable one. The indications are that the quality of the crops, where nitrate of soda was applied after the plants were partly grown, was inferior to that of plat H, to which no nitrate was added."

The comparison of linseed meal with cotton-seed meal and castor pomace was carried on for only 4 years. The following table shows the results:

Comparison of linseed meal with cotton-seed meal and castor pomace.

Plat.	Source of nitrogen.	Nitrogen per acre.	Average annual yield of leaf tobacco per acre.				Number of pole-cured leaves to pound.		Number of seconds holds fire.	
			Total.	Long wrappers.	Short wrappers.	Percentage of wrappers.	Long wrappers.	Short wrappers.	Long wrappers.	Short wrappers.
		Lbs.	*Lbs.*	*Lbs.*	*Lbs.*					
B	Linseed meal	105	1,501	664	222	59	61	85	12	15
A	Cotton-seed meal	105	1,585	732	219	60	63	85	14	15
E	Castor pomace	105	1,740	820	223	60	57	81	10	15

Two plats were dressed annually for 4 years with equal quantities of bone and double sulphate of potash and magnesia. In addition each plat received annually 105 lbs. of nitrogen per acre, one in the form of dry ground fish, the other in the form of cotton-seed meal. The results are tabulated below:

Comparison of fish with cotton-seed meal as a tobacco fertilizer.

Plat.	Source of nitrogen.	Nitrogen per acre.	Average annual yield of leaf tobacco per acre.				Number of pole-cured leaves to pound.		Number of seconds holds fire.	
			Total.	Long wrappers.	Short wrappers.	Percentage of wrappers.	Long wrappers.	Short wrappers.	Long wrappers.	Short wrappers.
		Lbs.	*Lbs.*	*Lbs.*	*Lbs.*					
Z	Dry fish	105	1,496	611	228	56	62	82	7.6	11.1
K	Cotton-seed meal	105	1,740	879	217	63	58	87	7.6	9.7

An experiment with stable manure and tobacco stems was begun on 2 plats in 1893 and continued during 4 seasons. These plats were uncultivated in 1892. One plat was dressed annually for 4 years at the rate of 10 to 12 cords of barnyard manure per acre. The barnyard manure is calculated to have supplied about 111 lbs. of nitrogen, 71 lbs. of phosphoric acid, and 149 lbs. of potash; the superphosphate about 15 lbs. of nitrogen, 72 lbs. of phosphoric acid, and 23 lbs. of potash. The other plat received annually 6,000 lbs. of tobacco stems, containing 111 lbs. of nitrogen, 36 lbs. of phosphoric acid, and 486 lbs. of potash. In 1893 and 1894 each plat received 500 lbs. of Swift Sure superphosphate in addition to the above applications. The following table gives the results:

Barnyard manure compared with cotton-seed meal and tobacco stems.

Plat.		Average annual yield of leaf tobacco per acre.				Number of pole-cured leaves to pound.		Number of seconds holds fire.	
		Total.	Long wrappers.	Short wrappers.	Percentage of wrappers.	Long wrappers.	Short wrappers.	Long wrappers.	Short wrappers.
		Lbs.	*Lbs.*	*Lbs.*					
A	Cotton-seed meal and cotton-hull ashes	1,585	733	219	60	63	85	14	15
AA	Stable manure	1,390	470	211	49	64	74	10	12
BB	Tobacco stems	1,654	745	231	59	67	85	10	12

"The much smaller crops raised on stable manure are explained in part by the fact that the nitrogen of stable manure is far less readily available than that of either stems or cotton-seed meal. . . . When no other fertilizers are used in connection with it the crop is rather light, at least for the first few years, till the land is well filled with the manure. The leaf is said to 'lack finish' when pole-cured, *but after fermentation* it is said to have a 'finish superior' to that raised on chemicals alone. . . .

"The successive crops from the plat AA, dressed with manure, ranked 13th, 17th, and 1st.

"Those from the plat BB (tobacco stems) ranked 16th, 21st, 19th, while the 3 corresponding crops on cotton-seed meal ranked 23d, 5th, and 14th."

Various forms of potash were tried on 7 plats, on 2 of which the experiment was carried on for only 4 years. The plats received each year 105 lbs. of nitrogen per acre in the form of cotton-seed meal, 340 lbs. per acre of potash in different forms, and 150 lbs. of phosphoric acid. In 2 cases lime was added at the rate of 300 lbs. per acre. The following table gives the results:

Comparison of the effects of various forms of potash as tobacco fertilizers.

Plat.	Source of potash.	Yield of leaf tobacco per acre.				Number of pole-cured leaves to pound.		Number of seconds holds fire.	
		Total.	Long wrappers.	Short wrappers.	Percentage of wrappers.	Long wrappers.	Short wrappers.	Long wrappers.	Short wrappers.
		Lbs.	*Lbs.*	*Lbs.*					
A	Cotton-hull ashes	1,615	740	241	61	66	89	14	15
K	Double sulphate of potash and magnesia	1,776	874	277	65	60	82	8	10
L	Double sulphate of potash and magnesia with lime	1,664	705	277	59	63	87	8	10
M	High-grade sulphate of potash	1,709	653	253	53	67	86	7	10
N	High-grade sulphate of potash with lime	1,690	742	272	60	64	85	8	11
O	Carbonate of potash	1,549	672	257	60	70	89	10	14
P	Double carbonate of potash and magnesia	1,416	601	263	61	66	87	13	12
Y	Wood ashes	1,482	631	199	56	69	91	12	17

The phosphoric acid applied to plats A and Y was chiefly in the ashes, while the other plats were supplied with it in the form of Cooper bone.

"The quality of the wrappers, judged from the 4 crops already examined by the expert, was about the same as that of wrappers of plat A, where cotton-hull ashes were used.

"The addition of lime had little effect on the quality of leaf.

"The plats dressed with high-grade sulphate of potash with and without lime, M and N, bore a larger average crop than any except K, and rather more wrappers than most of the others. But the leaves held fire for a shorter time than those from the other plats, and the quality of the 4 crops already examined was poorer than that of any others in the series.

"Plats O, P, Y, having as their source of potash carbonate of potash, double carbonate of potash and magnesia, and wood ashes, respectively, bore lighter crops than the others in their series, but the average quality, judged from the 4 crops from O and the 3 crops from P and Y, already examined, was the best in the whole experiment field."

A test of small quantities of potash in the fertilizer was made during 4 years on 2 plats designated B and F, which in 1892 had received 340 lbs. per acre in cotton-hull ashes and plat B had received 140 lbs. of nitrogen in cotton-seed meal, while plat F received an equal amount in the form of castor pomace.

During the experiment both plats received like quantities of nitrogen and phosphoric acid, but plat F received 150 lbs. of potash per acre while B received 340 lbs. The potash was applied in the form of cotton-hull ashes. The results of the 4 years are tabulated below:

Effects of different quantities of potash.

Plat.	Source of potash.	Potash per acre.	Average annual yield of leaf tobacco per acre.				Number of pole-cured leaves to pound.		Number of seconds holds fire.	
			Total.	Long wrappers.	Short wrappers.	Percentage of wrappers.	Long wrappers.	Short wrappers.	Long wrappers.	Short wrappers.
		Lbs.	*Lbs.*	*Lbs.*	*Lbs.*					
B	Cotton-hull ashes	340	1,501	664	222	59	68	89	12	17
F	.....do	150	1,600	669	260	58	66	91	9	14

"In this experiment about 900 lbs. of cotton-hull ashes per acre, or 190 lbs. of potash, was annually put on the land in excess of the crop requirements.

"As has been shown in previous reports, an average tobacco crop of 1,800 lbs. per acre, takes from the land not more than 150 lbs. of potash in stalks and leaves. When land has been fertilized for some years, it is probable that 150 lbs. of water-soluble potash annually applied is enough to secure a full crop of tobacco.

"An excess of potash, however, tends to neutralize the otherwise injurious effects of an excess of chlorids in the soil."

A test of mixed fertilizers supplied by manufacturers is reported and the results tabulated.

A study of the effects of all these fertilizers on the composition of wrapper leaf tobacco was made and the results of analyses are given in tabular form. The preparation of the samples and the methods of analyses are described and the results are discussed. The author summarizes his observations as follows:

"(1) The analyses represent the cumulative effects on the composition of the tobacco leaf of fertilizers applied for 4 and 5 years in succession.

"(2) The short wrappers have a somewhat larger percentage of ash, ether extract and nitrogen-free extract than the long wrappers and correspondingly less fiber, nicotin, nitric acid, and protein.

"Of ash ingredients the short wrappers contain a somewhat larger percentage of silica, soda, lime, magnesia, and oxid of iron, and a correspondingly smaller percentage of potash, phosphoric acid, sulphuric acid, and chlorin.

"(3) There are no differences in the percentages of ether extract, fiber, and nitrogen-free extract traceable to the different fertilizers used.

"Where fertilizer-nitrogen was applied in large excess of the probable crop requirements, a much larger percentage of nitrates was found in the leaf, amounting in one case to 3.78 per cent of nitric acid (N_2O_5), than where smaller quantities of fertilizer-nitrogen were applied.

"The percentages of protein and of nicotin were also above the average in tobacco to which the larger quantities of fertilizer-nitrogen had been applied.

"(4) The fertilizers used have had striking effects on the composition of the ash.

"(*a*) The largest percentage of potash was in tobacco to which most fertilizer-potash had been applied.

"The percentage of potash is least in the ash of tobacco from the plats dressed with potash in form of sulphate. The percentage of potash in the ash of the tobacco from those plats is also less than it is in the ash of tobacco from plats which were dressed with the same, or even half the same quantity of fertilizer-potash in form of carbonate.

"(*b*) The tobacco dressed with high-grade sulphate of potash and the ash of which contained a smaller percentage of potash than any other lot contains, on the other hand, the highest percentage of lime, and the tobacco dressed with the double sulphate of potash and magnesia also contains a relatively high percentage of lime.

"(*c*) In general the tobaccos which have most lime have least magnesia, and *vice versa*. Comparatively large percentages of magnesia are found in the lots of tobacco which were raised on plats dressed with fertilizers containing much magnesia. In the short wrappers of a single plat, P, the percentage of magnesia was larger than that of lime.

"The quality of the leaf has not been damaged in previous years by these large quantities of magnesia. Lots P, Y, F, and D, which have large percentage amounts of magnesia, have heretofore been among the best tobaccos as regards quality of leaf.

"(*d*) The percentage of sulphuric acid in the leaf is very much larger when sulphates are used in the fertilizer.

"It is believed that these large amounts of sulphuric acid impair the burning quality of the leaf, and in this experiment the 'burn' of tobacco from the plat which was dressed with high-grade sulphate has been very unsatisfactory.

"(*e*) The ash of tobacco from the plat dressed with stable manure contains 5 times as much chlorin as the ash from any other lot in the series."

Experiments in growing tobacco with different fertilizers: Final report on the fermented crops of 1895, E. H. JENKINS (*Connecticut State Sta. Rpt. 1896, pp. 285–301*).—This is a final report on the experiments reported in the Annual Report of the station for 1895 (E. S. R., 8, p. 395). The separate crops are described in detail and the comparative fire-holding capacity of the various lots is tabulated, the report being based on the examination of the samples which were cased down for fermentation. The shrinkage during fermentation amounted to 10.7 per cent. The author states that the nature of the change during the fermentation, and not the shrinkage, determines the effect on the quality of the leaf. Experiments were begun in 1892 and a full discussion of the work is postponed until 5 successive crops shall have been grown and fermented.

Experiments in growing tobacco with different fertilizers in 1896, E. H. JENKINS (*Connecticut State Sta. Rpt. 1896, pp. 302–310*).—These experiments are a continuation of the work reported by the station in 1895 (E. S. R., 8, p. 395). This report gives a description of the crop grown in 1896. Tables give the amount and kinds of fertilizers applied, the percentage of long and short wrappers, top leaves, and seconds obtained, and the comparative fire-holding capacity of the various crops. The methods of growing and harvesting the crop are described. This crop is the last in a series of experiments begun in 1892. Samples of this crop are now in process of fermentation and will be graded by an expert in the fall of 1897. "A complete review of the whole 5 years' work can then be given."

The author reports some of the results obtained during the 5 years, and the results of chemical analyses of wrapper leaf tobacco of the different lots are given in a table.

Report of the experiments in the manuring of oats, hay, turnips, and potatoes, R. P. WRIGHT (*Glasgow and West of Scotland Tech. Col., Agr. Dept. Rpts. 1896, pp. 101*).—Similar work has been formerly reported (E. S. R., 8, pp. 589–591). The chemical composition of the fertilizers used in these experiments is given. The results are tabulated and discussed and attention is called to some of the more important conclusions by introductory notes.

From the experiment of manuring the oat crop it was concluded that nitrate of soda and sulphate of ammonia, being readily available manures, generally give profitable increases, which are usually larger and more certain when the nitrogenous manures are applied with phosphate and potassic fertilizers, such as superphosphate and kainit. It is stated that superphosphate increases the proportion of grain and hastens ripening, and that kainit, in combination with superphosphate and nitrate of soda or sulphate of ammonia, strengthens the straw, hastens ripening, and increases the total yield. Barnyard manure produced a large increase in yield, but increased straw rather more than grain. The manurial experiments with the hay crop lead to the following conclusions:

"That neither bone meal nor basic slag applied alone have proved very effective manures for the hay crop in the first year of application.

"That basic slag applied along with muriate of potash has proved much more effective, and that this combination of manures has proved especially beneficial to clovers.

"That basic slag applied along with nitrogenous and potassic manures has shown itself somewhat more effective than superphosphate.

"That the application of nitrate of soda alone to the hay crop is not nearly so effective as when phosphatic and potassic manures are applied with it.

"That nitrate of soda applied alone gives a large and profitable increase of grasses, but diminishes clover, and this injures the aftermath and the subsequent pasture.

"That a combination of nitrogenous, phosphatic, and potassic manures . . . is highly beneficial to grasses and clovers alike, produces very large increases of hay both in the first cutting and in the aftermath, and gives a highly profitable return.

"That such a combination of artificials gives us large crops and crops of a better quality than barnyard manure.

"That barnyard manure gives a large increase of crop and gives a better return per ton when applied in a half rather than a full dressing.

"That a much better return for barnyard manure is obtained by applying it in a half dressing along with nitrate of soda than by applying it in a full dressing alone."

In the experiments with turnips it was found that basic slag applied in different ways and in different combinations was not so effective as superphosphate containing the same amount of phosphoric acid. This conclusion is said not to apply to peaty or mossy soils, on which different results have been obtained. The slag gave better results when sown in drills than when applied broadcast earlier in the season. On one plat in this experiment 888 lbs. of superphosphate, 100 lbs. of nitrate of soda, and 100 lbs. of sulphate of potash per acre were applied. The author recommends similar combinations as reliable turnip manures and states that phosphatic and potassic manures without nitrogen do not form a reliable manure for the turnip crop.

A short report is given on experiments of sowing several varieties of turnips and Swedish turnips on land infected with finger-and-toe disease.

An experiment with seaweed as a manure for potatoes is reported.

Winter barley for brewing purposes (*Deut. Landw. Ztg., 24 (1897), No. 92, p. 835*).

Studies of the carbohydrates in rye, barley, and wheat at different stages of development, H. JENSEN-HANSEN (*Medd. Carlsberg Lab., 1896, pp. 145–192; French résumé, pp. 69–89*).

Beet crop of Russia in 1896, S. ANTONOV (*Zemledyelie, 1897, pp. 62, 63*).—The beet crop of 1896 was 637,618 tons, 53.4 per cent of which was produced in the southwestern governments of Kiev, Volyn, and Podolia.

Experiments in electroculture of beets in 1896, N. I. KAZNAKOV (*Vyestnik Imper. Ross. Obsh. Sadov., 1896, pp. 457–459*).—Having obtained encouraging results in 1895, the author continued his experiments in 1896, but with rather indifferent results. The line of investigation will be pursued further. To produce an electric current, copper and zinc plates were placed at the opposite ends of the rows and connected by insulated wires.—P. FIREMAN.

Introduction of the carrot into England (*Farmers' Gaz., 56 (1897), No. 43, p. 654*).—A historical note. "It seems that this vegetable was not introduced into this country before 1510."

Cowpeas (Vigna catjang), J. G. SMITH (*U. S. Dept. Agr. Yearbook 1896, pp. 287–296*).—Several groups of varieties of the cowpea are described and its importance as a soil renovator and a forage plant is pointed out. The method of cultivation and harvesting and the ways in which the crop may be used are given. The forage value of cowpeas is compared with red clover and alfalfa. The chief functions of the crop are summarized as follows: (1) "To furnish a large amount of nitrogen abstracted from the air and fixed in the roots and stubble in a conveniently available form for the use of succeeding crops; (2) to produce a large yield of vines and peas rich in digestible protein, which, either as hay or for soiling purposes, will take the place of the concentrated nitrogenous foods; (3) to supply humus which acts directly and indirectly to produce fertility by breaking down and rendering available the basic minerals of the soil."

The cowpea, S. M. TRACY and E. R. LLOYD (*Mississippi Sta. Bul. 40, pp. 169–182*).—Directions are given in a popular way for planting, fertilizing, and using a crop of cowpeas and for saving the seed. A classification of varieties is given and the varieties adapted to special purposes are noted.

The culture of crimson clover, TANCRÉ (*Fühling's Landw. Ztg., 46 (1897), No. 20, pp. 606–609*).—The characteristics of the crop are discussed and directions for its culture are given.

Observations on the growth of maize continuously on the same land for nine years, E. H. JENKINS (*Connecticut State Sta. Rpt. 1896, pp. 335–341*).—The work of previous years is discussed in detail in the Annual Report of the station for 1895 (E. S. R., 8, p. 392). The results of the experiment in 1896 are given in tables without discussion, which is reserved.

Field crops, P. P. DEHÉRAIN (*Les plantes de grande culture. Paris: Georges Carré et C. Naud, 1898, pp. 236*).—A popular work on the culture of grains, potatoes, and beets. The discussions pertain to agriculture in France.

Introductory notes on the experiments of 1896, R. P. WRIGHT (*Glasgow and West of Scotland Tech. Col., Agr. Dept. Rpts. 1896, pp. 7–19*).—Notes on the methods of conducting experiments and drawing conclusions, with discussions on the various fertilizers used in the experiments.

How to preserve green forage (*Deut. Landw. Presse, 24 (1897), No. 85, p. 779*).—Directions are given on preserving green forage without the use of a silo.

The fixation of nitrogen in clay soils by the growth of leguminous catch crops, M. MAERCKER (*Braunschweig Landw. Ztg., 65 (1897), No. 41, pp. 179, 180*).—A report on experiments, with tabulated results.

Influence of a top dressing of nitrate of soda on poor stands of oats, F. LUBANSKY (*Zemledyelie, 1897, pp. 199, 200, 225, 226*).—Experiments carried out in 1895 and 1896 proved that nitrate of soda applied at the rate of 60 lbs. per acre is an effective remedy for improving poor stands of oats.—P. FIREMAN.

Potatoes, B. C. BUFFUM (*Wyoming Sta. Rpt. 1897, pp. 70, pls. 3*).—A reprint of Bulletin 32 of the station (E. S. R., 9, p. 239).

Potato breeding, F. SPIEGEL (*Deut. Landw. Presse, 24 (1897), No. 93, p. 845*).—The origin of a new variety of potatoes known as Daber's Elite is given by the originator.

Varieties of potatoes, W. PAULSEN (*Deut. Landw. Presse, 24 (1897), No. 92, p. 833*).—A report on variety tests of potatoes. The average yields for 5 years, the percentage of starch, and the amount of starch produced per hectare are given in tables.

Harvesting and storing potatoes (*Ztschr. Landw. Ver. Rheinpreussen, 14 (1897), No. 41, pp. 363, 364*).

Rotation experiment, J. R. CAMPBELL (*Glasgow and West of Scotland Tech. Col., Agr. Dept. Rpts. 1896, pp. 43–47*).—The experiment is described and the results are tabulated. This was the first year of the experiment.

Fertilizer experiments with potatoes (*Deut. Landw. Presse, 24 (1897), No. 83, p. 763*).—Comparisons were made of ammoniated superphosphate and guano and Thomas slag and nitrate of soda as fertilizers for potatoes. On a sandy soil ammoniated superphosphate was but slightly more effective than guano, but on heavy clay soil the difference in yield in its favor was more marked. The results of applying Thomas slag alone and with nitrate of soda were considerably in favor of the mixture.

Amount of nitrogen, phosphoric acid, and potash in peas and beans, E. H. JENKINS (*Connecticut State Sta. Rpt. 1896, p. 334*).—Analyses show that a certain crop of peas removed from an acre 47.8 lbs. of nitrogen, 13.1 lbs. of phosphoric acid, and 12.7 lbs. of potash, and a certain crop of beans 56.2 lbs. of nitrogen, 13.5 lbs. of phosphoric acid, and 22 lbs. of potash. The beans took about the same amount of phosphoric acid as the peas, but 9 lbs. more each of nitrogen and of potash.

The injurious effect on rye of the perchlorates in nitrates, B. SJOLLEMA (*Ann. Agron., 23 (1897), No. 7, pp. 328, 329*).—Abstracted from an article already noted (E. S. R., 8, p. 762) with note by P. P. Dehérain suggesting that chlorates may be formed from chlorids by microorganisms as bromates have been shown to be from bromids by Müntz (*Ann. Chim. et Phys., 6. ser., 11, p. 111*).

New experiences and observations in sugar-beet culture, HOLLRUNG (*Braunschweig Landw. Ztg., 45 (1897), No. 42, p. 183*).

Main points in sugar-beet culture, THÖMSGEN (*Ztschr. Landw. Ver. Hessen, 1897, No. 43, p. 390*).

Timothy in the prairie region, T. A. WILLIAMS (*U. S. Dept. Agr. Yearbook 1896, pp. 147–154, figs. 2*).—The reasons for the failures of timothy growing in the prairie region are pointed out and the methods of preparing seed and treating timothy meadows to secure a successful growth are stated. The method of growing timothy for seed and a comparison of analyses of eastern and western grown hay is given.

Improvements in wheat culture, M. A. CARLETON (*U. S. Dept. Agr. Yearbook 1896, pp. 489–498, figs. 1*).—The article treats of the method of tillage, time of seeding, selection of varieties, cross breeding, selection of seed, and of the 2 most important diseases—the smuts and rusts. Special prominence is given to the selection of varieties.

The author recommends the extension of the hard-wheat territory in the United States and the further trial of "the finest class of bread wheat in the world" which are grown in southeast Russia under "conditions very similar to those which prevail in our own wheat belt."

Wheat culture in South Alabama, J. F. DUGGAR (*Montgomery, Ala.: Dept. Agr., p. 7*).—Notes on wheat culture, with reference to varieties, choice and preparation of the soil, seed, time to sow, and fertilizers.

The culture of wheat, L. CAILLE (*Prog. Agr. et Vit., 28 (1897), No. 46, pp. 565–570*).—Discussions on preparation of the soil, rotation of crops, and application of fertilizers for successful wheat culture.

Correlation in Squarehead wheat, N. WESTERMEIER (*Fühling's Landw. Ztg., 46 (1897), No. 20, pp. 598–606*).—Two different forms of Squarehead wheat were grown for 4 years. The results are tabulated and described in detail. The author considers a strong stem, a smaller number of internodes, a shorter but mostly heavier head containing a larger number of grains, a smaller proportion of sterile spikelets, and a shorter leaf correlated with the shortening of the culm.

Autumn wheat manuring, J. HUGHES (*Farmers' Gaz., 56 (1897), No. 40, pp. 599, 600*).—Notes on the manuring of wheat, based on the results obtained by several English experimenters.

Seeding grass lands without a nurse crop, W. A. HENRY (*Wisconsin Sta. Rpt. 1896, pp. 66–73*).—At the station a field of 7.54 acres was sown to clover and timothy, 4 qt. of each being sown to the acre. The yield of hay per acre 71 days after sowing was 3,269 lbs. A table gives the results of cooperative experiments made in different parts of the state. From this and other experiences the author concludes that under ordinary conditions it is unnecessary to sow nurse crops with grass for the purpose of yielding shade and protection. Instructions are given for growing grasses under this system.

The size of the seed in its relation to the yield, F. DESPREZ (*Jour. Agr. Prat., 2 (1897), No. 37, pp. 416–420*).—Large and small seed of 5 varieties of wheat was sown. The total yields were in favor of the large seed except in 2 cases, where more straw was produced from the small seed. The results are tabulated.

Using sprouted grain for seed (*Landw. Wchnbl. Schleswig-Holstein, 47 (1897), No. 41, pp. 588, 589*).—Directions for sowing sprouted grain, with notes on the way in which the condition of the grain effects the stand.

The use of sprouted grain in distilleries (*Deut. Landw. Presse, 24 (1897), No. 72, p. 661*).

HORTICULTURE.

On the use of commercial fertilizers for forcing-house crops, E. H. JENKINS and W. E. BRITTON (*Connecticut State Sta. Rpt. 1896, pp. 205–229*).—This is a continuation of work recorded in the Annual Report of the station for 1895 (E. S. R., 8, p. 402). Experiments are reported with tomatoes, carnations, cucumbers, and radishes.

Tomatoes.—The purpose of the experiment was to test further the merits of a mixture of coal ashes and peat for forcing crops, and to study the effects of greater amounts of nitric nitrogen and phosphoric acid than were used in the previous experiments. The method of making the test was practically the same as before. Each plat had a surface area of 13.87 sq. ft. and was 9 in. deep. Six Lorillard tomatoes were set in each plat. The soil consisted of 1 part peat to about 30 parts coal ashes and a little calcium carbonate. When the first crop was removed, fertilizers were added to the various plats in sufficient quantities to replace exactly the amounts removed in the first crop and a second crop was planted.

Several tables are given showing the quantities of fertilizers applied to the soil and their equivalents in nitrogen, phosphoric acid, and potash; the quantities of these fertilizer constituents removed by the crop; the total yield of fruit, vines, and roots; the average yield of fruit per plant and per square foot of bench area; the average weight of fruits; the percentage of perfect shaped fruit; and similar data. The authors believe that in every case the efficiency of the nitrogen was limited by a scarcity of potash and that the crops took some potash from the coal ashes used as soil. In a few cases where the fertilizer applied contained no potash the plants were able to take considerable quantities of it from the ashes. The same was true of phosphoric acid. The principal data obtained from the tests of tomatoes in ashes and peat are brought together in the following table:

Tomatoes grown with different fertilizers.

Plat.	Fertilizer constituents.						Weight of—		Average weight of a single fruit.
	In the soil.			In the crop.					
	Nitrogen.	Phosphoric acid.	Potash.	Nitrogen.	Phosphoric acid.	Potash.	Fruit.	Roots and vines.	
First crop.	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*
9	32.7	8.1	29.3	12.68	5.09	18.74	2,987	271.1	57.4
10	32.7	10.0	35.0	13.88	5.53	20.97	3,847	290.7	55.6
11	40.0	10.0	35.0	14.92	6.14	22.54	4,425	294.1	70.8
12	47.0	10.0	35.0	17.26	6.31	25.54	5,274	322.3	64.7
13	40.0	10.0	40.0	19.15	6.85	33.47	7,548	383.1	84.5
14	47.0	10.0	45.0	21.65	7.29	36.51	8,042	406.6	84.2
27	40.0	0.0	35.0	13.30	4.28	21.75	4,269	308.7	79.0
28	40.0	4.0	35.0	17.04	5.10	24.75	5,140	327.8	87.0
29	40.0	8.0	35.0	13.34	4.29	19.52	4,804	351.0	65.0
30	40.0	10.0	35.0	15.49	5.81	24.01	5,795	313.5	79.0
31	40.0	12.0	35.0	19.83	7.05	30.12	6,599	387.0	70.0
32	40.0	15.0	35.0	20.66	7.59	31.24	7,214	387.5	78.0
Second crop.									
9	32.7	8.1	29.3	17.65	6.53	35.09	7,987	477.0	138.0
10	32.7	10.0	35.0	17.66	6.71	35.65	7,682	537.0	125.0
11	40.0	10.0	35.0	22.26	9.41	42.79	10,385	532.0	120.0
12	47.0	10.0	35.0	20.33	7.52	38.80	9,507	582.0	118.0
13	40.0	10.0	40.0	22.54	7.74	42.02	10,427	637.0	124.0
14	47.0	10.0	45.0	26.06	7.81	46.66	11,467	721.0	116.0
27	55.0	15.0	50.0	24.94	8.50	43.04	8,902	686.0	113.0
28	55.0	21.0	50.0	24.14	7.77	39.00	9,661	452.0	112.0
29	55.0	21.0	50.0	24.18	7.12	36.95	9,405	659.0	117.0
30	55.0	24.0	50.0	31.33	10.15	54.19	10,135	808.0	97.0
31	55.0	27.0	50.0	24.28	7.79	42.48	9,337	556.0	102.0
32	55.0	30.0	50.0	25.14	7.90	43.12	8,950	520.0	108.0

Tomatoes were also grown in compost of 2 parts turf and 1 part manure. Fertilizers were applied to some of the compost plats, but they did not increase the yield. In the following table the results obtained from the compost plats are compared with the results from those plats of coal ashes and peat which received the largest amounts of fertilizers.

Tomatoes produced in compost and in ashes and peat.

Plats.	Average weight of fertilizer constituents per plat—						Average weight of fruit per plat.	Ratios of phosphoric acid to nitrogen and potash in crop.
	Applied to soil.			Removed by crop.				
	Nitrogen.	Phosphoric acid.	Potash.	Nitrogen.	Phosphoric acid.	Potash.		
	Grams.	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	
Compost, 18, 19, 22, 23, 37	....	....	....	27.3	10.5	54.9	9,209	1:2.6:5.2
Ashes and peat, 30, 31, 32	55.0	27.0	50.0	26.9	8.6	46.6	9,474	1:3.1:5.4
Ashes and peat, 12, 13, 14	44.7	10.0	40.0	23.0	7.7	42.5	10,467	1:3.0:5.5

The authors give the following summary of results:

"(1) A crop of tomatoes, started in September and beginning to bear in December, was only seven-tenths as large as one started 3 months later, when the amount of sunlight was daily increasing.

"(2) The largest quantities of nitrogen, phosphoric acid, and potash taken by any one crop (plat 30, February to July, 1896), per 100 sq. ft. of bench space, were as follows:

	Grams.	Equivalent to—	Pounds.	Ounces.
Nitrogen	226	Nitrate of soda	3	10
Phosphoric acid	74	Dissolved boneblack	1	
Potash	391	Muriate of potash	1	12

"The crop on this plat amounted to 1.6 lbs. of tomatoes per square foot of bench space, but other crops of 1.8 lbs. took no larger quantities of fertilizer ingredients from the soil.

"(3) Somewhat less than two-thirds of these fertilizer ingredients were contained in the fruit.

"(4) To enable the plants to get these fertilizer elements as required there should be a large excess of them in the soil.

"(5) With the larger amounts of fertilizer chemicals used on the plats this year larger quantities of nitrogen, phosphoric acid, and potash have gone into the fruit. Every 100 lbs. of ripe tomatoes has taken:

	Ounces.	Equivalent to—	Ounces.
Nitrogen	2.9	Nitrate of soda	18.2
Phosphoric acid	1.2	Dissolved boneblack	7.5
Potash	5.0	Muriate of potash	10.0

"(6) By the use of fertilizer chemicals and a soil consisting of anthracite coal ashes mixed with a little peat (3 per cent) there has been no difficulty in raising a larger crop of tomatoes than was raised in a rich compost either with or without fertilizer chemicals.

"The quantities of fertilizer chemicals which gave the maximum yield in our experiments were, per 100 sq. ft. of bench:

	Pounds.	Ounces.	Cost.
			Cents.
Nitrate of soda	4	11	11.8
Dissolved boneblack		15	1.2
Muriate of potash	1	2	2.4
Total			15.4

"In our tests the average yield from coal ashes and peat was one-tenth larger than from the compost.

"(7) The plants began to bear at about the same time on both soils.

"During the first 2 weeks the yield of fruit from compost was the larger, for the next 3 weeks the ashes and peat produced the most, and thereafter the yield per week from compost was generally larger than from ashes and peat, although the total yield for the season was largest on the latter.

"Two-fifths of the whole crop from the coal ashes and peat was harvested within 1 week. Naturally this comparison is only applicable to the particular soils under experiment. That composts may differ very greatly in their adaptability to the growth of particular crops is matter of common observation.

"(8) Roots growing in coal ashes and peat have not been affected by nematode galls."

Carnations.—Three plats, each having an area of about 7 sq. ft., were planted with Garfield, Lizzie McGowan, and Daybreak carnations. The soil of one plat was compost without fertilizers; of another plat, compost with the addition of 29 gm. of nitrate of soda, 14.8 gm. muriate of potash, and 12.25 gm. of dissolved boneblack; of a third plat, ashes and peat, with the addition of twice the quantities of fertilizers used in the compost plat.

A table is given showing the number and average diameter of flowers produced by each variety in each plat. No analyses of flowers or plants were made. A more extensive experiment is to be reported later. The authors say: "These cultures prove that good carnations may be grown in coal ashes and peat with fertilizer chemicals, and that both the number and the average diameter of the flowers may be considerably greater than where a portion or the whole of the plant food is supplied by soil or manure."

Cucumbers.—A preliminary experiment was made with fertilizers for cucumbers. Each of the 20 plats in the test contained an area of about 14.5 sq. ft., and received 10.3 gm. of phosphoric acid and 56.2 gm. of potash in the forms of dissolved boneblack and muriate of potash respectively. Five plats containing coal ashes and peat, received in addition from 24 to 64 gm. of nitrogen in the form of nitrate of soda and 5 received equivalent quantities in the form of cotton-seed meal; each of the 10 compost plats received 32 gm. of nitrogen, part as nitrate of soda and part as cotton-seed meal. Seed of Arlington White Spine cucumbers was sown May 1. Early in July the plants in ashes and peat were much larger than those in compost, and the ones given nitrate nitrogen were thriftier than those given nitrogen in cotton-seed meal. The experiment was concluded about the middle of September. The plants in compost produced 85.5 lbs. of cucumbers per hundred square feet of bench area, and those in ashes and peat 99 lbs.; the average weight of a single cucumber being 7.2 oz. in the former case, and 7.4 oz. in the latter. In ashes and peat the 2 forms of nitrogen were about equally efficient, but in compost the cotton-seed meal was much more efficient as a nitrogen source than the nitrate of soda. The cucumbers grown in compost contained 0.095 per cent nitrogen, 0.053 per cent phosphoric acid, and 0.222 per cent potash; those in coal ashes and peat 0.083 per cent nitrogen, 0.032 per cent phosphoric acid, and 0.207 per cent potash. The vines and roots contained the following quantities of fertilizer constituents per plat: With compost soil, nitrogen 5.69 gm., phosphoric acid 1.20 gm., potash 12.08 gm.; with ashes and peat, nitrogen 4.54 gm., phosphoric acid 0.61 gm., potash 7.77 gm.

Radishes.—The soils used in this test were a mixture of ashes and peat as before, and a compost of garden soil with one-third its bulk of manure. Commercial fertilizers were used in varying amounts. Three crops of Cardinal Globe radishes were grown. The plants were pulled when only $\frac{3}{4}$ in. in diameter, and tied in bunches of 10 each. Eight bunches grown in compost weighed 568 gm., and contained 0.222 per cent nitrogen, 0.066 per cent phosphoric acid, and 0.342 per cent potash. Eight bunches grown in ashes and peat weighed 574 gm., and contained 0.235 per cent nitrogen, 0.048 per cent phosphoric acid, and 0.235 per cent potash. A table is given showing the quantities of fertilizers applied to each plat, and the number and weight of radishes produced in each. The authors believe that "since the number of radishes from each plat depends upon the quality of the seed used, and the weight depends almost entirely upon the age of the plants, no great stress should be placed upon either the number of bunches or the weight of crop in estimating the comparative profits of the crops." In all cases the radishes grown in ashes and peat reached marketable size from 1 to 4 days earlier than those grown in compost, and were quite as smooth, tender, and crisp.

Experiments in subwatering, E. S. GOFF and F. CRANEFIELD (*Wisconsin Sta. Rpt. 1896, pp. 243–251, figs. 3*).—A new method of subwatering greenhouse plants is described in detail. The greenhouse bench is lined inside with galvanized iron forming a water-tight pan 2 or 3 in. deep. A layer of bricks set edgewise in the pan conducts the water gradually to the soil above. The soil used consisted of 2 parts sand, 2 parts loam, and 1 part sheep manure.

Comparisons were made between subwatered and surface-watered beds for growing a number of crops. In the first trial with lettuce 234 plants of the Grand Rapids variety were grown in each bed. The seed was sifted and only the larger seeds were sown. The young plants were watered by placing the seed box in shallow pans of water. One hundred and seventy-one plants from the subwatered bed weighed 10,572 gm., and an equal number from the surface-watered bed, 8,306 gm. The leaves of the lettuce from the subwatered bed were more tender and crisp than from the other. In the second trial with lettuce, sifted seed was sown as before, but the young plants in seed boxes that were intended for the surface-watered bed were surface watered and those for the other bed, subwatered. Eighty-three plants from the subwatered bed averaged 58.5 gm. in weight and 89 from the surface-watered bed averaged 46.8 gm. The plants from the subwatered bed were of better quality than the others.

A similar test was made with Lentz Early beets and Early Forcing carrots. From the subwatered bed 79 beet plants weighed 3,827 gm. and the roots 402 gm. From the surface-watered bed an equal number of plants weighed 3,232 gm. and the roots 381 gm. In the case of carrots 44 plants from the subwatered bed weighed 628 gm. and their roots 190 gm., while 51 plants from the surface-watered bed weighed 365 gm. and their roots 126 gm.

A modification of the subwatered method in which the bricks were laid flat instead of on edge resulted unsatisfactorily. The water was not transmitted uniformly to the soil and more frequent waterings were required.

In other trials hollow building tiles 12 in. square by 4 in. thick were used. The water was readily transmitted to the soil by this arrangement. As regards growth of plants, there was little difference between tile and brick set edgewise, but with cuttings there was considerable difference in the formation of callus and roots. The authors say, "In several trials made with both herbaceous and woody cuttings, it was observed in nearly every instance that the development of callus was least over the tiles, intermediate over the brick, and most in the ordinary surface-watered bed, while the root development was in inverse order, viz, greatest over the tile and least in the surface-watered bed."

In another test the building tiles were arranged so that the hollow spaces in them formed continuous flues through which the air passed after being heated by the steam pipes beneath the bench. The circulation of air through the flues was excellent, but the average temperature of the soil was no higher than in case of the other beds. In another test the tiles were arranged to form flues as above and the interior surface of the walls of the flues was heavily coated with asphalt to prevent evaporation from the moist tiles. Again little or no difference in the temperature of the beds was noticed.

Pots of coleus, geraniums, and petunias were placed in sand in beds arranged one with tiles and one with bricks for subwatering and another in the ordinary way for surface watering. In about a month the plants were shifted from 2½ in. pots to 4 in. ones. The plants in the tile and brick beds were badly wilted for several days after being repotted, but at the end of the test, some 10 weeks later, they had a considerably greater development of top and root than plants in the surface-watered bed. The plants in the subwatered beds rooted through the pots more than in the other bed. In regard to root development the authors say, "In the ordinary bed the roots were curled about the bottom of the pot and in a less degree half way to the top. In the tile and brick beds the roots covered the entire exterior of the root-ball evenly to the top." The Golden Bedder coleus was deeper yellow and the geraniums were deeper green in the surface-watered bed than in the other beds.

The extra cost of adding the arrangement for subwatering was about equal to the first cost of an ordinary bench. The authors believe that, "Taking into account the superior growth of plants on the subwatered bench, the greatly reduced cost of attendance, and the presumed greater durability of the bench, the extra first cost will soon be made up."

The improvement of our native fruits, L. H. BAILEY (*U. S. Dept. Agr. Yearbook 1896, pp. 297–304*).—It is the belief of the author that, in the improvement of fruits, the things most needed rather than those intrinsically best deserve most attention. In reviewing what has been done in the way of improving our native fruits, the author states that in "nearly every case the amelioration has come from the force of circumstances and not from the choice or design of men." To illustrate this the history of the improvement of native grapes, plums, raspberries, and the like, is noted. To show the obverse, how difficult it is to improve fruits which are not forced upon us, the attempts to introduce huckleberries, various nuts, etc., are noted. The introduction of new types of fruit for which there is no apparent necessity is generally a forced effort. A number of specific illustrations of the origin of the cultivated varieties of grapes are given to show that in most cases the new forms are chance discoveries. The author believes, however, that, in the improvement of plants, an intelligent choice of kinds has played an important part in the past and will play a more important part in the future.

Contrary to the opinion of many writers, the author believes that the introduction of new types of fruits, while important, is less so than the improvement of types already introduced and that with the introduced types the most promising results are to be looked for through the further improvement of the forms already highly improved rather than through work with the original wild stock. Plant breeders should work along the line of natural evolution rather than against it, endeavoring to intensify the desirable characters which already existed in the wild sorts. It is thought that there are needed more special purpose varieties of all fruits, more widely unlike varieties, and more minor strains of the most popular ones. The native grapes, in the estimation of the author, need first attention, the native plums next, then the native raspberries and blackberries, and next the amalgamation of western crab apples with domestic apples, etc.

Notes on fruits, E. S. Goff (*Wisconsin Sta. Rpt. 1896, pp. 210–232, figs. 11*).—Notes are given on the Conrath Early raspberry, the Dwarf Rocky Mountain cherry, the goumi, and a number of varieties of apples, plums, and grapes. The quality of *americana* plums was found to vary considerably in different seasons. With the deficient rainfall of 1894, the trees produced a larger crop than the following year and the fruit was of poorer quality. This was especially noticeable with the Wyant plum. The fruit from several trees in 1894 was so astringent as to be nearly worthless, while the following year the same trees produced an excellent quality of fruit with hardly a trace of astringency.

The author believes from comparisons made in 1895 that in quality of fruit the best varieties of *americana* plums, such as Rockford and Ocheeda, have some points of superiority over some of the best *domestica* varieties.

Miscellaneous horticultural work, E. S. Goff (*Wisconsin Sta. Rpt. 1896, pp. 233–242*).—The study of the fertility of the flowers of native plums previously reported (E. S. R., 8, pp. 309, 692) has been continued during the past year. A table is given showing the percentage of perfect pistils in the blossoms of 13 varieties of plums in the years 1894, 1895, and 1896.

With reference to the plum curculio, the author considers that the "jarring process" is not a complete remedy and that in addition to it all infested fruit should be promptly gathered and destroyed.

A test of alcoholic vapor as a preservative of fresh strawberries is reported. Six quarts of fresh Warfield strawberries were kept in a refrigerator for 3 days, half of them being kept under a bell jar with a small open bottle of 98 per cent alcohol. The berries not covered with the bell jar molded considerably in the center of the boxes but the least molded ones retained their normal flavor. The berries exposed to alcoholic vapor under the bell jar retained their fresh appearance and showed no trace of mold, but lost their normal flavor and acquired that of weak vinegar. In a second trial 5 boxes of berries were placed on glass plates in a refrigerator and covered with bell jars. Under the first bell jar was placed a dish of water, and under the second, third, fourth, and fifth bell jars dishes of $6\frac{1}{4}$, $12\frac{1}{2}$, 25, and 50 per cent alcohol, respectively. In 2 days the berries exposed to the vapor of the $6\frac{1}{4}$ per cent alcohol were considerably molded and their flavor was destroyed the same as those with the stronger alcohol.

Descriptive notes are given on the Siberian pea tree (Caragana). The plant is recommended as a good flowering shrub for severe climates, having endured both the cold winters and hot, dry summers and produced abundant blossoms each spring.

The use of Dendrolene on the trunks of apple trees as a remedy for borers resulted in killing 57 trees out of 180 treated and severely injuring a large part of the remainder. The material was applied the last of May and the first of June, the trunks of the trees being coated about $\frac{1}{4}$ in. thick from the first limbs to a couple of inches below the surface of the soil. The leaves of many of the trees began to die in a few days after the application was made. In a few months many of the trees were dead, in others the cambium layer was dead entirely around the trunk, and the trunks of trees whose tops were still fresh were noticeably larger above the Dendrolene than where it was applied. Newly planted trees were affected sooner than trees that were set 1, 2, and 3 years before.

Notes are given on studies of the "tip burn" of potatoes. Everett Heavy Weight, Rural New Yorker No. 2, Green Mountain, and Everett Colossal have proved resistant to tip burn, while some older varieties have been badly affected. The author suggests that this difference may be due to a reduction in vigor of the old varieties.

New forcing house, W. E. BRITTON (*Connecticut State Sta. Rpt. 1896, pp. 229–231, pl. 1*).—Brief descriptive notes on the station forcing house, with ground plans.

Lath shading for glass houses, E. S. GOFF and F. CRANEFIELD (*Wisconsin Sta. Rpt. 1896, pp. 252–255, figs. 2*).—A method of shading greenhouses with lath screens is described and illustrated.

New vegetables, W. W. TRACY (*Gard. and Forest, 10 (1897), No. 512, p. 495*).—Descriptive notes on Gregory Surprise pea, Gradus pea, and Golden Hubbard squash.

Mushroom culture on an extensive scale, E. WINDISCH (*Die Champignonkultur in ihrem ganzen Umfange. Neudamm: J. Neumann, 1897, pp. 153, figs. 94*).

Edible and poisonous mushrooms, P. VOGLINO (*Funghi velenosi e mangerecei italiani. Turin: G. B. Paravia, 1897, colored pls. 2*).

Edible and poisonous fungi, F. CAVARA (*Funghi mangerecei e funghi velenosi. Milan: U. Hoepli, 1897, pp. 208, pls. 43*).

The agricultural chemistry of the cacao (Theobroma cacao), J. B. HARRISON (*The Rocks and Soils of Grenada and Carriacou, and the Agricultural Chemistry of Cacao. London: Waterlow & Sons., Ltd., 1896, pp. 30–56*).—This is a quite extensive study of the composition of the whole fruit and different parts of the fruit of a number of varieties and of the changes which the beans undergo in fermentation and curing, and an account of a fungus disease known as black cacao.

Tea culture in the Caucasus, G. VADARSKI (*Vyestnik Imper. Ross. Obsh. Sadovdstva, 1896, pp. 439–453*).

Experiment station tests of new strawberries, B. F. SMITH (*Amer. Gard., 18 (1897), No. 151, p. 774*).—The author believes that at least 50 plants of any variety should be grown before deciding upon its merits. He also criticizes the way in which the quality, productiveness, etc., are reported, and believes that some old variety should be chosen as a standard of quality, some other old variety as a standard of productiveness, etc., and the new varieties compared with the standards.

Influence of plant food on the quality and properties of fruit, H. E. STOCKBRIDGE (*Georgia State Hort. Soc., 1897, pp. 20–25*).—A discussion of the respective effects of nitrogen, potash, and phosphoric acid on the growth of plants and quality of fruit. A table showing the potash and phosphoric acid content of a number of fruits is the basis of the author's belief that there is a definite relation between the ratio of potash to phosphoric acid and that of sugar to acid in fruits.

Olive culture in the United States, N. B. PIERCE (*U. S. Dept. Agr. Yearbook 1896, pp. 371–390, pl. 1, figs. 4*).—The paper treats of the status of the industry in the United States, methods of propagation, location of orchards, planting, pruning, pollination, character of fruit, selection of varieties, extraction of oil, pickling, diseases, etc. The author believes that olives could be profitably grown on the great area of dry hillsides in California. The conditions in these localities are very similar to those in parts of Italy and Sicily where olives are grown. The method of culture employed in these countries is given. As regards the necessity of cross pollination, experiments in California have shown that some varieties are perfectly self-fertile, while others are entirely self-sterile.

Methods of propagating the orange and other citrus fruits, H. J. WEBBER (*U. S. Dept. Agr. Yearbook 1896, pp. 471–488, figs. 13*).—The principal methods of propagation employed by citrus nurserymen and growers in Florida are described.

Japanese plums, S. A. BEACH (*Gard. and Forest, 10 (1897), No. 509, pp. 464, 465*).

Pruning and training of grapes, E. G. LODEMAN (*U. S. Dept. Agr. Yearbook 1896, pp. 499–542, figs. 24*).—All the more common methods of grape pruning and training are described and many of them illustrated. The principles involved are discussed.

Subirrigation for large foliage beds, F. CRANEFIELD (*Wisconsin Sta. Rpt. 1896, pp. 256–259, figs. 2*).—A successful method of subirrigating large foliage beds where it is difficult to water the plants thoroughly with hose or sprinklers is described and illustrated. The soil was removed to a depth of 6 in. and 3 in. drain tile was laid. A line of tile extended across the bed with branch lines on each side of it about a foot apart.

Application of chemical fertilizers to plants in pots, H. DAUTHENAY (*Rev. Hort., 69 (1897), Nos. 22, pp. 514–518, figs 3; 23, pp. 541–544, fig. 1*).—A discussion of the work of G. Truffaut and A. Hébert.

Achillea (*Garden, 52, No. 1358, pp. 421, 422, figs. 6*).—Descriptive notes on 24 species of these ornamental plants.

The pink color in chrysanthemums, W. MILLER (*Gard. and Forest, 10 (1897), No. 511, pp. 486, 487*).—The author notes the possible means of controlling color variations in pink chrysanthemums. In an experiment made during the past season a large supply of nitrogen in the plant food did not deepen the pink color as is often claimed. Shading the plants weakens the color very noticeably.

Recent importations among chrysanthemums, W. MILLER (*Gard. and Forest, 10 (1897), No. 509, p. 465*).

The native dahlias of Mexico, J. W. HARSHBERGER (*Science, n. ser., 6 (1897), No. 155, pp. 908–910*).

The new sweet peas for 1897, R. B. WHYTE (*Canad. Hort., 20 (1897), No. 11, pp. 419–423*).—Descriptive notes on 25 varieties of sweet peas.

FORESTRY.

Willows at the Chico Forestry Station, C. H. SHINN (*Gard. and Forest, 10 (1897), No. 512, p. 497*).—The author gives brief notes upon the condition of a number of species of willows planted at the Chico Forestry Station. The collection was begun in 1895, plantings being made of 24 selected varieties. In 1896 and again in 1897 others were added to the collection until now there are about 40 distinct varieties being grown.

In February, 1896, from 5 to 10 plants of each kind were set out in a permanent plantation. No irrigation or special care has been given the trees. At the time of the report they were about 30 months old, and the average growth of what seemed to be the most promising species is given. *Salix salmoni*, an Old World species, showed remarkable growth. In the nursery the cuttings made roots and sent up stems 10 ft. high within 6 months after planting. In February, 1896, 5 trees were cut back to single stems 2 ft. high. In August, 1897, two of them were 31 and 32 ft., respectively, in height, and their trunks exceeded 18 in. in circumference at 2 ft. from the ground.

The average growth of some of the leading species is given below, age, soil, culture, and other conditions being in all cases the same.

	Feet.		Feet.
Salix salmoni	30	*Salix sieboldii*	10
alba vitellina	18	*madeni*	8
regalis	15	*cordata*	6
caprea	14	*riminalis* (female plant)	5
daphnoides	13	*lucida*	4
viminalis (male plant)	12	*purpurea*	4
pentandra	10	*discolor*	3

"The best native willows under similar conditions appear to rank in point of growth somewhere between *Salix sieboldii* and *S. regalis*."

The Araucaria forests of Chile and Argentina, F. W. NEGER (*Forstl. Naturw. Ztschr., 6 (1897), No. 11, pp. 416–426, figs. 5*).

Are the trees receding from the Nebraska plains? C. E. BESSEY (*Gard. and Forest, 10 (1897), No. 508, pp. 456, 457*).—The author states that some species are not receding, and as to others the evidence is not conclusive as to their advancing or retreating.

Concerning the influence of weather on tree growth, J. FRIEDRICH (*Centbl. Gesam. Forstw. Wien, 23 (1897), No. 11, pp. 471–495, figs. 3*).

Influence of climate on tree growth, J. FRIEDRICH (*Ueber den Einfluss der Witterung auf den Baumzuwachs. Vienna: Wilhelm Frick, 1897, pp. V, 160, pls. 25, figs. 40*).

Concerning the afforestation of waste lands (*Landw. Centbl. Posen, 25 (1897), No. 30, pp. 184, 185*).

Tree planting in waste places on the farm, C. A. KEFFER (*U. S. Dept. Agr. Yearbook 1896, pp. 323–340*).—Popular notes on the needs and purposes of tree planting, selection of varieties, methods of planting, care of trees, etc.

The Californian ash-leaved maple, J. C. WEINELT (*Oesterr. Forst. u. Jagdw. Ztg., 15 (1897), No. 46, p. 366, figs. 2*).—Notes are given on *Acer californicum*.

Notes on cultivated conifers, C. S. SARGENT (*Gard. and Forest, 10 (1897), No. 512, pp. 490, 491, figs. 2*).

Notes on cultivated conifers, VIII, C. S. SARGENT (*Gard. and Forest, 10 (1897), No. 509, pp. 460, 461*).—Notes are given of the cultivated species of Pinus.

Forest planting in the Kiev government, I. REV (*Zemledyelie, 1897, pp. 151, 152, 177–179*).

Concerning the effect of lightning on trees, D. JONESEN (*Diss. Lausanne, 1897; abs. in Bot. Centbl. Beihefte, 7 (1897), No. 3, pp. 208, 209*).

SEEDS—WEEDS.

The superior value of large, heavy seed, G. H. HICKS and J. C. DABNEY (*U. S. Dept. Agr. Yearbook 1896, pp. 305–322, figs. 10*).—General remarks are made on seed selection, the principles involved in it, methods, etc. Experiments to test the effect of size and weight of seed on plants grown from them are reported. The seed used was of known origin, all seed of each variety having been grown in one place. The seed was divided into 2 lots, heavy and light. The plants were given sand culture in a greenhouse under identical conditions as far as possible. A number of figures of the plants in different stages of their growth are given.

The results with soy beans were as follows, the experiment being closed when the plants were in bloom:

Average growth of soy beans from 5 heavy and 5 light seeds.

Kind of seed.	Weight.							Height of plant.	Number of leaves per plant.	Length of taproot.	Diameter of stem.
	Fresh.				Air dry.						
	Seed.	Root.	Shoot.	Plant.	Root.	Shoot.	Plant.				
	Gm.	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Mm.*		*Mm.*	*Mm.*
Heavy	0.202	6.22	11.00	17.22	0.80	4.60	5.40	412.4	22.8	214.6	4.2
Light	.082	3.56	6.44	10.00	.38	2.44	2.82	277.2	13.6	256.8	3.1

The authors state that, "although the average root length was greater in soy beans grown from light seed, the total root development was much less." A diagram is given showing that, contrary to the observations of Hellriegel, the difference in plants from heavy and light seed was most marked toward maturity, there being less difference in the early stages of growth.

Pea plants from large seed began to blossom 4 days earlier than those from small seed, produced the first marketable peas 4 days earlier, and the main crop 5 to 6 day's earlier. The results are given in the following table:

Average growth of peas from 4 heavy and 4 light seeds.

Kind of Seed.	Weight (air dry).						Length.		Number of leaves.	Size of pods (combined).			Number of pods per plant.	Number of peas per plant.	Diameter of shoots.
	Seed planted.	Root.	Shoot.	Hull.	Seed.	Plant.	Root.	Shoot.		Length.	Breadth.	Thickness.			
	Gm.	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Mm.*	*Mm.*		*Mm.*	*Mm.*	*Mm.*			*Mm.*
Heavy ...	0.260	2.27	1.10	0.399	1.646	5.421	291	887	12	120	33	20.0	2.5	8.2	3.0
Light	.103	.77	.55	.190	.903	2.418	236	620	11	88	25	13.5	.2	5.2	2.6

The results with beans were very similar to those with peas, both as regards growth and earliness. The average weight of fresh roots of 2 bean plants from large seed was 13.35 gm. and from small seed 4.3 gm.

An experiment was made with a number of plants to compare the germination of heavy and light seed. From 50 to 100 heavy and light seeds of each variety were planted. The results are given in tabular form. The authors consider the experiment too limited to warrant conclusions being drawn with reference to germinative power, but with reference to growth of seedlings the results were quite marked, as is shown in the following table:

Weight of heavy and light seed and of seedlings from the same.

Kind of seed.	Radish.		Corn.		Kafir corn.		Vetch.		Sweet pea.		Rye.		Oats.		Barley.	
	100 seeds.	58 seedlings.	100 seeds.	43 seedlings.	100 seeds.	47 seedlings.	50 seeds.	47 seedlings.	50 seeds.	41 seedlings.	50 seeds.	45 seedlings.	50 seeds.	49 seedlings.	50 seeds.	— seedlings.
	Gm.	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*
Heavy	1.77	49.5	2.41	23.5	3.30	22.0	4.08	33.0	6.09	58.0	1.11	34.5	1.30	37.2	{ 2.52 2.15	39.5 34.5
Light	1.04	31.5	1.36	12.0	1.74	13.0	2.10	18.0	4.05	44.4	.75	20.0	0.81	25.0	{ 1.50 0.96	29.0 23.0

Seed production and saving, A. J. PIETERS (*U. S. Dept. Agr. Yearbook 1896, pp. 207–216, figs. 8*).—Seed production is popularly discussed from both botanical and practical points of view. The effects of cross and self fecundation are considered, and some of the agencies effecting cross pollination are noted. Home growing, harvesting, and storing seed are briefly considered.

The preparation of seed to prevent its being eaten by birds, M. HOFFMANN (*Deut. Landw. Presse, 24 (1897), No. 82, p. 750*).—Directions are given for the treatment of different kinds of seed and the results of experiments to determine the effect of the treatment on the power of germination are reported.

Migration of weeds, L. H. DEWEY (*U. S. Dept. Agr. Yearbook 1896, pp. 263–286, figs. 15*).—The various agencies, both natural and artificial, which aid the migration of weeds, the geographical distribution of several prominent weeds, the direction of weed migration, the development of migratory habits by cultivation, etc., are considered.

Weeds as indices to soil fertility (*Farmers' Gaz., 56* (*1897*), *No. 38, p. 571*).—The kinds and conditions of soils in England considered to be indicated by the presence of certain plants are discussed.

Cuscuta and its destruction, G. HEUZE (*Jour. Agr. Prat., 2* (*1897*), *No. 48, pp. 815, 816*).

DISEASES OF PLANTS.

On the probable winter condition of the fungus of peach scab, W. C. STURGIS (*Connecticut State Sta. Rpt. 1896, pp. 269–271*).—The author received early in March specimens of peach twigs which showed evidences of a diseased condition. Microscopic examination of both diseased and normal bark showed the same condition prevailing as the result of fungus growth upon peach and apricot. At the time of the first examination careful search failed to show any spores in connection with the mycelium, but later twigs were collected showing a connection between the spores and mycelium.

The author considers the evidence conclusive that the fungus causing the scab of peaches and other stone fruits passes the winter in a sterile condition on the twigs of the previous season's growth. Thus far the winter condition has not been observed on other than peach, apricot, and almond trees. The occurrence of the fungus upon the twigs suggests the advisability of cutting away and burning the new wood while the fungus upon it is still dormant. In less severe cases great benefit would probably result from 2 thorough sprayings with a solution of 1 lb. of copper sulphate to 25 gal. of water applied to the trees before the buds begin swelling in the spring. If the previous crop of leaves or fruit has shown much scab it is recommended to gather and burn all the refuse before the copper sulphate is applied.

On the susceptibility of various root crops to potato scab and the possibility of preventive treatment, W. C. STURGIS (*Connecticut State Sta. Rpt. 1896, pp. 263–266*).—On land that was known to be thoroughly infested with the potato scab fungus experiments were made with radishes, parsnips, salsify, turnips, carrots, ruta-bagas, mangel-wurzels, and beets. The rows were furrowed out and solutions of lysol and corrosive sublimate were applied as equally as possible from a watering pot and the seed sown. The germination of the seed and the growth of the plants were extremely irregular owing to the chemicals, while the check rows which had been treated with water only showed good growth and gave a perfect stand in every instance.

From the results of the experiments as given it appears that beets, mangel-wurzels, turnips, and ruta-bagas are susceptible to a marked degree if planted in soil infested with potato scab fungus, while radishes, parsnips, salsify, and carrots show little if any susceptibility to the disease. It also appears that solutions of either corrosive sublimate or lysol applied before seeding to soil infested with potato scab will decidedly lessen the amount of scab upon root crops subject to the disease. It is, however, questionable whether these solutions used in sufficient strength to secure partial immunity of the crop will not so greatly decrease the yield as to render their use impracticable.

Blight, burn, or scald of tomato plants, W. E. BRITTON (*Connecticut State Sta. Rpt. 1896, pp. 232–234*).—A report is given of a blight which attacked tomatoes grown under glass. The disease began at the tips of the leaves and gradually extended until nearly the entire leaf was dead and dry. The upper most rapidly growing parts remained longest unaffected, but finally all except the youngest leaves showed the presence of the disease.

Specimens of the diseased plants were submitted to B. T. Galloway, of this Department, and L. H. Bailey, of Cornell University, and by them the disease was considered to be the same as that of the burn or sunscald which results from insufficient water supply to the roots, and is most noticeable upon plants when bright sunshine follows cloudy weather. However, in the case of the present attack the blight made visible progress under a continuously and densely clouded sky. As a possible explanation of the disease under these circumstances it is suggested that probably cold currents of air under the benches chilled the roots to such an extent that the plants were not sufficiently provided with water.

A destructive fungus disease of tobacco in South Carolina, W. C. STURGIS (*Connecticut State Sta. Rpt. 1896, pp. 273–278, pl. 1, figs. 3*).—A disease which was found occurring on half-cured wrapper tobacco leaves received from South Carolina is figured and described. It appears as brown circular spots from the size of a pin head up to half an inch or more in diameter scattered thickly over the upper surface of the leaves. These brown spots are sometimes marked with whitish centers bordered by a darker slightly raised line. Toward the tips and edges of the leaves they frequently coalesce forming large brown blotches of irregular outline. Microscopic examination of the diseased spots showed that they were invaded by a species of fungus which has been described by Ellis and Everhart as *Cercospora nicotianæ*.

The author briefly describes various other leaf diseases of tobacco and compares them with the one under discussion. As probable preventive means he suggests Bordeaux mixture, ammoniacal copper carbonate solution, or flowers of sulphur. He believes it possible that judicious fertilizing might so far increase the vigor of the plants as to render them less subject to the disease if not exempt from its attack, analyses of the fertilizers used having shown a deficiency in potash.

Experiments on the prevention of potato scab, W. C. STURGIS (*Connecticut State Sta. Rpt. 1896, pp. 246–262*).—The author conducted a series of experiments to test (1) the comparative value of corrosive sublimate and lysol for the prevention of scab upon potatoes; (2) the comparative value of corrosive sublimate, lysol, and sulphur in preventing scab on infested lands; and (3) the comparative effect of fresh and composted manure in favoring the development of potato scab, and the comparative value of corrosive sublimate, lysol, and sulphur in preventing scab upon clean land.

In the first experiment the seed used was completely infested with scab. The tubers were washed, divided into 5 lots, and treated with lysol, 0.1, 0.5, and 1 per cent solutions and a corrosive sublimate solution (1 oz. to 6 gal. of water).

After treatment the seed potatoes were spread out to dry, and cut and planted as usual. The external effect of the lysol was very marked. In the case of the two stronger solutions the etiolated sprouts were of a pale brownish-red color, while the green sprouts were uninjured, except the young leaf buds, which were blackened.

Observations on the growth of the plants showed no very marked irregularities except where a 1 per cent solution had been used. These plants were 3 or 4 days later than the others in appearing above ground. Some hills failed entirely. The crop was light and composed of very small tubers.

The potatoes were all dug August 28 and graded. The yields from the different plats are tabulated. From the tabulation it is seen that corrosive sublimate as a preventive of potato scab gave the best results. The 0.1 per cent solution of lysol was not sufficient to secure disinfection of the seed, and the others materially injured the seed and lessened the crop.

In connection with these experiments the fungicidal and insecticidal value of lysol and Bordeaux mixture was tested. As an insecticide lysol possessed little value as compared with Paris green, and as a fungicide it failed to check the early blight of potatoes. Dry Bordeaux mixture mixed with Paris green and dusted over the potato plants proved inferior both as a fungicide and an insecticide to Bordeaux mixture used in liquid form.

In the experiment to test the comparative value upon infested land of corrosive sublimate, lysol, and sulphur the seed was soaked for an hour and a half in 0.1, 0.5, and 1 per cent lysol solutions; rolled in sulphur, and sulphur sown in each hill; or soaked in corrosive sublimate solution. The plat where this trial was conducted produced the previous year a crop of potatoes 75 per cent of which was scabby. The results of this experiment are tabulated and summarized by the author as follows:

"(1) Where the soil is infested with scab fungus the crop of tubers will be seriously diseased if no preventive treatment is applied. The disease will be further aggravated under such conditions by the use of scabby seed. The use of infested land for potatoes should therefore be discountenanced.

"(2) Lysol used in 1 per cent solution injures the seed when the latter is allowed to remain 1½ hours in contact with it. Weaker solutions are almost inoperative when used upon either clean or scabby seed planted on infested land.

"(3) Sulphur is an unsatisfactory preventive of potato scab, no matter what the quality of the seed, when the soil is infested. It further tends to roughen the surface of tubers growing in contact with it.

"(4) Of the three fungicides used, corrosive sublimate is the only one which can be recommended as a preventive of potato scab. Its efficiency is diminished by the presence of the fungus in the soil.

"(5) Infested land is to be avoided in planting potatoes. If its use is unavoidable, the selection of clean seed and treatment of the same with corrosive sublimate will enhance the value of the crop."

In the last experiments, made to test the comparative value of fresh and composted manure in favoring the development of potato scab and of corrosive sublimate, lysol, and sulphur in preventing scab upon clean land, clean seed was used in the experiment with barnyard manure and scabby seed in the other trials. Comparative tables are given showing the effect of the different treatments in which it appears that barnyard manure as a fertilizer for potatoes tends to produce scab upon the crop and consequently should be avoided. The results secured with lysol and sulphur confirm those given above.

Notes on the so-called shelling of grapes, W. C. STURGIS (*Connecticut State Sta. Rpt. 1896, pp. 278–281*).—The author briefly reports upon the character, cause, and probable prevention of this disease, which has previously been reported upon in Bulletin 76 of the New York Cornell Station (E. S. R., 6, p. 732).

The soft spot of oranges, R. E. SMITH (*Bot. Gaz., 24 (1897), No. 2, pp. 103, 104, pl. 1*).—The cause of the well-known soft spot or decay of oranges is determined to be a species of Penicillium. The described species with which it most nearly agrees is *P. digitatum.*

Moist atmosphere and close packing of the fruit favor the development of the fungus.

On a leaf blight of melons, W. C. STURGIS (*Connecticut State Sta. Rpt. 1896, pp. 267, 268*).—A leaf blight of melons is described which appears to be due to a disturbance of equilibrium existing between the absorption of water by the roots and its evaporation from the leaves. Under the circumstances it is said to be difficult to offer any suggestions for the prevention of the injury, but some system of providing for thorough drainage during rainy weather and protecting the vines in case of sudden appearance of sunshine might in a measure avoid the difficulty.

Mycological notes, B. D. HALSTED (*Bul. Torrey Bot. Club, 24 (1897), No. 11, pp. 505–510*).—Notes are given of a pineapple mold due to a fungus identical with or closely allied to *Chalara paradoxa;* root galls on peach; and some natural enemies of the asparagus rust. The last named are *Tubercularia perisicinia* and *Darluca filum,* which are parasitic on the æcidial and puccinia phases of the fungus.

Rust of asparagus, W. C. STURGIS (*Connecticut State Sta. Rpt. 1896, pp. 281, 282, pl. 1, figs. 4*).—A rust of asparagus which is causing considerable injury to the asparagus crop is figured and briefly described. The author considers it possible that some fungicidal treatment may prove available, but the thorough burning of all diseased material in autumn or late summer will probably give better results than the application of fungicides.

Diseases of shade and ornamental trees, B. T. GALLOWAY and A. F. WOODS (*U. S. Dept. Agr. Yearbook 1896, pp. 237–254, figs. 5*).—The paper treats in a popular way of the diseases due to soil conditions, air conditions, and fungus enemies. Preventive measures are noted.

Atlas of the diseases and injuries of cultivated plants, O. KIRCHNER and BOLTHAUSER (*Atlas der Krankheiten und Beschädigungen unserer landwirthschaftlichen Kulturpflanzen. Stuttgart: E. Ulmer, 1897, pp. III, 62, colored pls. 22*).—Treats of the diseases, etc., of grasses, forage, and other plants.

The diseases of cultivated plants and fruit and forest trees, E. PRILLIEUX (*Maladies des plantes agricoles, et des arbres fruitiers et forestiers causées par des parasites végétaux. Paris, 1897, vol. 2, pp. 596*).

Root rot of tobacco caused by Thielavia basicola, V. PEGLION (*Atti R. Accad. Lincei, 5. ser., 299 (1897), No. 2, p. 52*).

On the evolution of black rot, A. PRUNET (*Prog. Agr. et Vit., 28 (1897), No. 47, pp. 598–690*).

The barberry as a host plant for grain rusts, J. ERIKSSON (*Landw. Vers. Stat., 49 (1897), No. 1–2, p. 83*).

Treatment for leaf curl of plum, W. C. STURGIS (*Connecticut State Sta. Rpt. 1896, p. 281*).—A brief note is given in which it is stated that trees which received thorough treatment with Bordeaux mixture in 1895 were completely protected the following season from attack of leaf curl.

Concerning the effect of formalin on grain smuts, T. GEUTHER (*Ber. Pharm. Gesell., 5, pp. 325–330; abs. in Jahresber. Agr. Chem., 19 (1897), p. 418*).—The author reports that 0.1 per cent solutions in 2 hours destroyed Ustilago spores and 0.25 per cent solutions reduced the germination of grain. Seed of legumes soaked in 0.2 per cent solutions for 24 hours were injured. Soaking spores of *Ustilago carbo* for 24 hours in 0.05 per cent solutions did not kill the spores.

Observations on the treatment of black rot, CAZEAUX-CAZALET (*Rev. Vit., 1897, No. 167, pp. 234–236*).

On spraying tomatoes with copper solution, C. TEYXEIRA (*Gior. Farm. Trieste, 2 (1897), p. 71; abs. in Vrtljschr. Chem. Nahr. u. Genussmtl., 12, No. 2, p. 286*).—The author found 0.02 to 0.05 gm. copper in 1,000 gm. tomato juice when tomatoes were sprayed with copper sulphate and none when they were sprayed with Bordeaux mixture.

ENTOMOLOGY.

The asparagus beetles, F. H. CHITTENDEN (*U. S. Dept. Agr. Yearbook 1896, pp. 341–352, figs. 6*).—After a few general introductory remarks, noting that the 2 important beetles attacking asparagus are not native forms, the author discusses the first, the common asparagus beetle (*Crioceris asparagi*), noting the damages done by it, its present and probable future distribution, its habits, life history, natural checks, and remedies.

The insect is now known to have extended its range up the Hudson River and into Ohio. Its spread inland, except in the neighborhood of water, has been limited. In time, however, it will probably spread over the whole of the upper Austral life zone.

Under the head of natural checks there are noted the spotted ladybird (*Megilla maculata*), the spined soldier bug (*Podisus spinosus*), the armored soldier bug (*Stiretrus anchorago*), *Polistes pallipes*, and *Agrion positum*. For the larvæ the best remedy is thought to be air-slaked lime dusted on the plants in the early morning while the dew is on. Cutting down all the plants in early spring and forcing the beetles to lay in the new shoots which are to be cut down from day to day is also commended. Among other remedies noted is one employed by Klein, consisting of 1 part of a mixture of soft soap and quassia decoction (equal parts), and 5 parts of water.

The twelve spotted asparagus beetle (*Crioceris duodecimpunctata*) is similarly discussed. During 1896 it was found in Charles County, Maryland, and made a serious invasion into Prince George County, in the same State. As usual, it was accompanied by the common asparagus beetle, which arrived first. The spread of the insect from Monroe County, New York, where it was found in 1894, is less rapid than from the southern starting point. This is the northern limit of the upper Austral life zone, and the further spread of the insect may be expected to be southwest along this zone.

At present its range embraces the southern half of New Jersey, the whole of southeastern Pennsylvania, and northeastern Virginia. Though its starting point was different, this species has followed almost the same course as *Crioceris asparagi*, especially southward along the coast line. Like that species, too, its spread inland is slow; but later it will, no doubt, invade all the territory now affected by that species.

As yet the life history is imperfectly understood. The eggs still remain unknown, as well as much of the larval history. A few larvæ have been found, one upon the leaves of the food plants, the others in the berries. In Europe there are 2 broods, and the insect winters as pupæ during the second one; but here there is good reason to believe, especially in the southern range, that there are more than 2 broods and that the insect winters in the adult state. The remedies for the common species apply to this one also.

Insect control in California, C. L. MARLATT (*U. S. Dept. Agr. Yearbook 1896, pp. 217–236, pl. 1, figs. 2*).—The author notes the distinctive cultural conditions of California which require irrigation and limit orchards to well-defined tracts and permits orchard inspection and insect control, as well as the climatic conditions which have no inconsiderable influence. The great dry heat during summer, for instance, is inimical to the black scale and also to the imported ladybird and to pruning. The system of inspection and quarantine that has been developed by the State is thought most important. Under this system the main aim is prevention. If even a few scales are discovered, the treatment is prompt and often more extensive than would be thought necessary elsewhere. To this promptness and thoroughness of action is attributed the excellent condition of the orchards, especially in the citrus districts. The worst scale insects of California are thought to be the black scale (*Lecanium oleæ*), which occurs all over the State and commands the most attention, but so far as great injuries are concerned it is limited to the coast region, mountainous districts being thus far unfavorable to it, though it is slowly extending its range to them and becoming acclimatized; the red scale (*Aspidiotus aurantii*) on citrus trees, with the black scale damaging old seedling orchards, especially in the vicinity of Los Angeles; in the district of Riverside, Red Lands, Pomona, Ontario, etc., it is not bad; the San José scale (*Aspidiotus perniciosus*) is placed third in importance and is very much less injurious now than in its earlier history, especially in the Santa Clara Valley and in southern California. Climatic conditions often kill it out, but it is still somewhat injurious, notwithstanding statements to the contrary. It is often attacked by a fungus as well as by insect enemies, the most active of which are *Chilocorus bivulnerus* and *Aphelinus fuscipennis*, which are more useful in the East since they breed throughout the year. The standard California remedy—the lime, salt, and sulphur wash—is thought effective against it. Other injurious insects noted are the white scale (*Icerya purchasi*), which is now of little importance; the long scale (*Mytilaspis gloverii* and *M. citricola*), introduced about 1888–'90 from Florida; the rust mite (*Phytoptus oleivorus*), which has gained a foothold about San Diego and injures chiefly the lemon; the clover mite or red spider (*Bryobia pratensis*); the peach tree borer (*Sannina pacifica*), the peach twig borer (*Anarsia lineatella*), and the grape root louse (*Phylloxera vastatrix*).

After the introduction of *Vedalia cardinalis*, to a subsequent similar experiment is attributed the saving of the citrus industry. The history of the introduction of these beneficial insects is briefly passed over, and of the 5 or 6 species introduced, *Rhizobius ventralis*, *R. debilis*, *R. toowoombæ*, *R. toowoombæ-lophantæ*, *Orcus chalybeus*, and *O. australasiæ* are noted as having obtained a foothold and as most important in the vicinity of Santa Barbara. The last-mentioned form has practically disappeared on account of climatic conditions and also of an almost complete disappearance of its food insect, the black scale. Large colonies of such introduced insects sometimes fail, to some extent, at least, in consequence of being attacked by small lizards and birds, but in notable instances the ladybird, *Rhizobius ventralis*, has completely exterminated the black scale and seems to be doing so in other instances. Spraying is shown to be prejudicial to the development of ladybirds, and it is believed by some that spraying where ladybirds are should be prohibited.

Other important insects thought worthy of note are *Cryptolæmus montrouzieri*, *Novius kœbelei*, *Comys fusca*, which parasitizes the brown apricot scale, *Lecanium armeniacum*, to the extent of 75 or 90 per cent, and the twice-stabbed ladybird, *Chilocorus bivulnerus*, an enemy of the San José scale, which is thought more important than any of the imported species.

Continuing, the author discusses the subject of control of insects by the use of washes and by fumigation. The process of "gassing" or "fumigating" differs but little from the method employed some years ago; refined cyanid (98 per cent) is now used in preference to the fused (58 per cent) grade. The latter does not give uniform results. The former may be used in a smaller quantity. Relative to the amount to be used, a table prepared by J. Scott is given, and the statement made that enough of the cyanid should be used to slightly scald the tender terminals of the tree. Forty to forty-five minutes' exposure is thought sufficient. Very compact trees require about one-third more of the gas than others.

The tents now employed are the sheet tent and the ring tent. Thirty-six to forty of the latter may be handled by 4 men, and an experienced crew with 1 director can treat 350 to 400 five-year-old trees, averaging 10 ft. high, per night of 12 hours, at a cost of 8 cts. per tree. With 12 to 15 of the other tents about 50 trees 30 ft. high can be treated in the same time at a cost of about 75 cts. per tree. The method of gassing is thought the most thorough of all methods.

An oil for the tents, better than ordinary oils used it is stated, may be obtained from the leaves of the prickly pear (*Opuntia englemanni*). It is obtained by soaking the chopped leaves in water for 24 hours, giving body by an addition of yellow ocher or venetian red, and applying to both sides of the canvas.

The steam method is claimed to be cheaper than the method of gassing and not to affect the beneficial insects, but it does not kill the scales on the fruit. Further, the apparatus necessary renders it very clumsy. The superheated water method, which has the advantage of dispensing with a pump is noted in this connection also.

Kerosene emulsion[1] is used to a very considerable extent, especially at San Diego and Santa Barbara. The distinctively California insecticide, the resin wash, is more generally used than the last remedy. The formula employed varies in different localities, the general one for the summer wash being 20 lbs. resin, 5 lbs. crude caustic soda (78 per cent, or 3½ lbs. 98 per cent) in 2½ pt. fish oil. For the winter wash 30 lbs. resin, 9 lbs. crude soda, 4½ pt. fish oil. In both cases the mixture is diluted to 100 gal.

The Dayton wash, which has been recently introduced, is said to be cheaper, costing but 2 cts. per gal., and is diluted 1:80 or 1:100 for the young of the black scale and used in stronger solution for the red scale. The salt, lime, and sulphur wash is very effective in California, though not so in the East. It is less successful in California along the coast where moist conditions prevail. The chief consideration in making it seems to be prolonged boiling, forming practically a wash of sulphid of lime with free lime and salt. The proportions of the ingredients differ according to locality.

The apparatus employed in the State is practically as used elsewhere.

The use of steam apparatus for spraying, L. O. Howard (*U. S. Dept. Agr. Yearbook 1896, pp. 69–88, figs. 15, pls. 2*).—After a few general remarks, in which it is noted that the adoption of steam power spraying apparatus has been a necessary outcome of the great extension in the use of hand-spraying machines during the past decade, the author considers machines for orchard spraying and those for spraying shade trees in cities and towns. Several machines for each purpose are described.

[1] It is stated in a footnote that kerosene emulsion was used 30 years ago by Schoenfeldt, the head gardener of the Royal Gardens of Bavaria, which is very much earlier than has heretofore been noted.

The development of shade and ornamental tree spraying by individuals or companies who make it their business is noted. The plan is thought defective to the extent that many property owners are unable to employ such a person or company; but this defect appears only from the standpoint of complete protection. During the winter of 1895 and 1896 a company was formed in New York which had a number of excellent steam spraying machines constructed and did a very considerable amount of tree spraying during the summer of 1896. The initial experiments, on the large elms on the Yale College campus, were witnessed by the author. The machine used had a tank of 300 gal. capacity, mounted on a strong platform 4 by 10 ft. in size, and this upon wagon trucks, constructed especially for the apparatus. The engine had a capacity of 4 horsepower and threw 4 streams, with a discharge pressure of 60 lbs. each, through $\frac{3}{4}$-inch hose, 200 ft. lengths and nozzle rods each 10 ft. long. The McGowan nozzle was used. Even the tallest trees on the campus were quickly sprayed. But the machine is criticised for an unnecessary waste of material and a disagreeable amount of dripping from trees when spraying, but this is a difficulty found with other machines, owing to the fact that a sufficiently finely divided spray is not obtained. A Cyclone nozzle, it is thought, would give better results.

As to the danger of poisoning in spraying on such a large scale, the author could learn of only one case which seemed to indicate that the contact of the spray with the skin might be injurious, and this case was doubtful.

Concluding, it is stated that aside from the first cost of apparatus, spraying by steam power on a large scale is economical, and that extensive orchardists may find it profitable to construct such apparatus, and in fruit-growing communities it may be found profitable to engage in the business of spraying. Cities or towns having abundant shade trees are advised to provide such steam apparatus for spraying.

The oral apparatus of the Microlepidoptera, K. W. GEUTHE (*Zool. Jahrb. Abt. Syst., 10 (1897), No. 4, pp. 373–471, pls. 3*).—Summarizing his extensive investigations the author says that the labrum of the Microlepidoptera is a somewhat broad distally directed plate of more or less rectangular ground form, with rounded corners, which on the distal margin is broadly and deeply cleft, almost to the base. Mandibles occur generally. They are in one case (Micropteryginæ) in the form of angular, sharp, horny-toothed structures. The first pair of maxillæ are provided with cardo, stipes, lobus externus and internus, and palpus maxillaris only in the Micropteryginæ. In all other cases they show a decided reduction, so that only short small basal pieces corresponding to the cardo and stipes, with palpus and lobus externus, remain. The last is transformed into the coiled tongue, while the lobi approach one another closely to form the canal, thus forming the typical lepidopteran tongue. In the Microlepidoptera it is entirely similar in detail to that in the Macrolepidoptera. Only in a few cases is it simpler and rarely is it more or less reduced. The second pair of maxillæ are typical, or with the cardines united to the submentum and the stipes to the mentum and the lobi and palpus free, only in the Micropteryginæ. In all other cases the lobi disappear completely, the cardines and stipes remain small, and the chitinous border bears both the labial palpi.

Capture plants for insect pests (*Gard. Chron., 3. ser., 22 (1897), No. 544, p. 346*).

Artificial increase, or dividing colonies (*Gard. Chron., 3. ser., 22 (1897), Nos. 549, p. 5; 550, p. 19*).—The author states the methods successfully employed by himself.

Notes on New England Acridiidæ III. Œdipodinæ VII, A. P. MORSE (*Psyche, 8 (1897), No. 257, pp. 111–114*).—*Psinidia fenestralis, Trimerotropis maritima,* and *Circotettix verruculatus.* Structural and general biological features are noted.

Insect life, J. H. COMSTOCK (*New York: D. Appleton & Co., 1897, pp. 349, figs. 296*).—An introduction to nature study and a guide for teachers, students, etc.

Catalogue of the Coleoptera of Japan, H. VON SCHOENFELDT (*Jahrb. Nassau. Ver. Naturkunde, 50 (1897), pp. 97–144*).—The third part.

Preliminary handbook of the Coleoptera of Northeastern America, R. HAYWARD (*Jour. New York Ent. Soc., 5 (1897), No. 3, pp. 133–149*).

A new Aleurodes on Rubus from Florida, T. D. A. COCKERELL (*Jour. New York Ent. Soc., 5 (1897), No. 2, pp. 96, 97*).—The pupæ of this insect (*Aleurodes ruborum*) were found abundant on the under side of the leaves of a cultivated Rubus at Lake City, Florida, by A. L. Quaintance. The adult insect emerged about the middle of February. Mr. Cockerell supposes that the insect is a native of Florida and not an introduced form, as thought by its discoverer, Mr. Quaintance. It is distinguished from the European, *A. rubi,* by the black legs and spotted wings of the latter. It can not be *A. rubicola,* which has a yellow body and immaculate white wings and in which the pupa is not black.

Notes on the transformations of the higher Hymenoptera, II, A. S. PACKARD (*Jour. New York Ent. Soc., 5 (1897), No. 2, pp. 77–87, figs. 3*).—Descriptions of the larvæ and pupæ of *Pobistes canadensis, Halictus parallelus, H. ligatus, Andrena vicina,* and *Nomada imbricata.*

Insect notes, W. E. BRITTON (*Connecticut State Sta. Rpt. 1896, pp. 234–245, pls. 6*).—The report notes the insects that attracted most attention during the year. Cankerworms (*Paleacrita vernata* and *Anisopteryx pometaria*), army worm (*Leucania unipuncta*), currant stem girdler (*Phylloecus flaviventris*), fruit bark beetle (*Scolytus rugulosus*), *Heliothrips astri,* and asparagus beetle (*Crioceris asparagi*) are mentioned. Ordinary remedies are recommended.

Life histories of the New York slug caterpillars, VII–IX, H. G. DYAR (*Jour. New York Ent. Soc., 5 (1897), No. 1, pp. 1–14, pls. 2*).—The author discusses *Tortricida fasciola* (food plants—wild cherry, white birch, barberry, dogwood, chestnut, sugar plum, oak, linden, maple, beech, hornbeam, hickory, and huckleberry), *Adoneta spinuloides* (food plants—willow, oak, wild cherry, barberry, linden, witch hazel, chestnut, beech, and sour gum (Nyssa)), and *Euclea indetermina* (food plants—various kinds of low brush, also wild cherry, oak, hickory, and barberry).

Carnivorous slugs, M. WEBSTER (*Gard. Chron., 3. ser., 22 (1897), No. 566, p. 314*).—The slugs (*Testacella haliotidea*) have often been found by the author swallowing earthworms entire.

Carnivorous slugs, D. R. DIXON (*Gard. Chron., 3. ser., 22 (1897), No. 568, p. 348*).—It is stated that a slug was found in the act of devouring an earthworm.

Odonate nymph from a hot spring, D. S. KELLICOTT (*Jour. Cincinnati Soc. Nat. Hist., 19 (1897), pp. 63–65; abs. in Jour. Roy. Micros. Soc. [London], 1897, pt. 4, p. 280*).—Nymphs were taken from water that was near the boiling point.

The buffalo tree hopper, C. L. MARLATT (*U. S. Dept. Agr., Division of Entomology Circ. 23, 2d ser., pp. 4, figs 2*).—A brief popular account is given of the appearance, habits, life history, food plants of and injuries from *Ceresa bubalus.* The remedies and preventives recommended fall under the head of clean culture and trap plants.

Injurious insects and the use of insecticides, F. W. SEMPERS (*Philadelphia: W. A. Burpee & Co., 1896, 3. ed., pp. 216, pl. 1, figs. 184*).—A compilation from the bulletins of this Department and other sources.

Two insect pests, S. DE L. VAN RENSSELAER STRONG (*Gard. and Forest, 10 (1897), No. 490, p. 278*).—Notes on the butternut woolly worm. It is stated to be ordinarily rather rare in New Jersey, and the larvæ yield readily to an arsenical spray or a mixture of 1 lb. of Paris green in 200 gal. of water. It was discovered in a natural grove of oak and hickory in New Jersey. *Phytomyza aquilegiæ* is also noted as destroying columbine plants.

Strawberries destroyed by beetles (*Gard. Chron., 3. ser., 22 (1897), No. 549, p. 12*).—*Harpalus ruficornis* is said to have developed an undoubted taste for ripe strawberries. The litter around the plants harbors the beetles. The author recommends preventive measures which are briefly mentioned.

The pistol case bearer (Coleophora malivorella), V. H. LOWE (*Gard. and Forest, 10 (1897), No. 485, pp. 224, 225, figs. 2*).—A popular article on the life history, habits, and mode of attack of this pest.

The plant-house Aleyrodes, W. E. BRITTON (*Gard. and Forest, 10 (1897), No. 482, p. 194, fig. 1*).—An article containing notes on the appearance, habits, and host plants of this insect.

Larch (*Gard. Chron., 3. ser., 22 (1897), No. 549, p. 12*).—The pine weevil (*Hylobius abietis*) is noted as destroying the larch. Hand picking, surface culture of ground beneath the trees, and the use of artificial shelter as traps are recommended. The application of quicklime and diluted paraffin oil on the ground or as a wash for the trunks is mentioned.

Mouth parts of insects, J. B. SMITH (*Trans. Amer. Phil. Soc., 19 (1897), pp. 175–198, pls. 3; abs. in Jour. Roy. Micros. Soc. [London], 1897, pt. 4, pp. 280, 281*).

The Colorado potato beetle in Mississippi, H. E. WEED (*Mississippi Sta. Bul. 41, pp. 185–190, figs. 5*).—A brief account of the history of this insect (*Doryphora decemlineata*), its life history, destructiveness, and remedies. A map shows that the beetle was present in injurious numbers during 1896 in a broad belt running diagonally across the middle of the State and in 2 of the northern border counties. A comparison is made with the bogus potato beetle.

The spread of the San José scale in Connecticut, W. C. STURGIS (*Connecticut State Sta. Rpt. 1896, pp. 282–284*).—Out of 43 replies received in answer to circulars sent out 13 report the scale present and 2 are doubtful. The scale seems to be widely spread throughout the State. A word of warning is given regarding the substance known as Dendrolene. Favorable results have followed the use of the substance obtained from its originator, while all the complaints that have been made against it came from those who have employed the substance as made by other manufacturers.

A San José scale disease, P. H. ROLFS (*Gard. and Forest, 10 (1897), No. 484, pp. 217, 218*).—The discovery is announced that the fungus *Sphærostilbe coccophila* is an effective and practical remedy for this scale in Florida and doubtless in California. The author's reasons for his belief in its efficacy are succinctly given.

The phylloxera, J. DUFOUR (*Chron. Agr. Canton Vaud, 10 (1897), No. 15, pp. 395–402, figs. 3*).

Remarks on the alterations produced by the phylloxera on the roots of the vine, J. DUFOUR (*Chron. Agr. Canton Vaud, 10 (1897), No. 14, pp. 379–384, figs. 4*).—The alterations are classified as noduosities or swellings and as tuberosities. The first are more or less curved, sometimes so as to form a U. They are formed by a phylloxera attaching itself near the point of a small root which in growing curves around it. Several insects attacking the root from the same side accentuate the curve. If the attack is on opposite sides of the root the tendency of the swelling is, as a whole, to remain straight. The tuberosities are formed on the larger roots.

The grass root aphids of Russia, N. CHOLODKOVSKY (*Zool. Anz., 20 (1897), No. 530, pp. 145–147, figs. 3*).—Describes *Colopha rossica, Vivipara alata, Paracletus cimiciformis.* A note on *Schizoneura fodiens* states that this species has been received from the Crimea, where it was found on roots of *Ribes grossularia* and *Vitis vinifera.*

Ambrosia beetles, H. G. HUBBARD (*U. S. Dept. Agr. Yearbook 1896, pp. 421–430, figs. 7*).—This popular article is virtually a rearrangement and condensation of an article by the same author in U. S. Dept. Agr., Division of Entomology Bulletin 7, an abstract of which will be given later.

Fir-tree oil as an insecticide, W. G. STURGIS (*Gard. and Forest, 10 (1897), No. 487, p. 249*).—Notes are given on the use of fir-tree oil against certain insects not amenable to insecticides. A species of aphis, the larvæ of 1 or more species of Cacorcia, and a leaf hopper were parasitic upon hardy roses in the vicinity of New Haven, Connecticut. After a 2 years' trial with various decoctions and powdery applications the author declares that "for general utility, thorough effectiveness, ease of application, and cleanliness," nothing equals fir-tree oil.

Foul brood and its treatment, T. W. COWAN (*Rev. Internat. Apiculture, 19 (1897), No. 6, pp. 98–103, fig. 1*).—This is translated into French from the fourteenth edition of Cowan's guide for the English beekeeper. Cowan recommends the thorough disinfection of hives and utensils. When a diseased hive is to be treated and not destroyed he recommends that the hive be washed out with phenol (phenol 2 teaspoonfuls, water ½ gal.) and the diseased brood frames sprayed with a weaker solution (½ teaspoonful to ½ gal. of water). From other frames the honey is to be extracted and boiled and the frame treated like the brood frames. The bees are to be fed a sirup containing phenol at the rate of ¼ teaspoonful to ½ gal. of sirup. If it is accepted by the bees more phenol should be added.

On fungi living upon insects, G. LINDAU (*Ent. Nachr., 13 (1897), No. 15, pp. 225–230, fig. 1*).

FOODS—ANIMAL PRODUCTION.

The effect of adding increasing amounts of fat upon the digestibility of rations, A. WICKE and H. WEISKE (*Landw. Vers. Stat., 48 (1897), No. 6, pp. 390–400*).—The author made experiments similar to those previously reported (E. S. R., 8, pp. 321, 616, 617) to study the effect of adding increasing quantities of fat to the rations of sheep. The test which was divided into 4 periods of 7, 6, 6, and 5 days each, was made with 2 sheep weighing about 60 and 57 kg., respectively. The basal ration of sheep No 1 consisted of 1,000 gm. meadow hay and 250 gm. linseed cake; and of sheep No. 2, 750 gm. meadow hay and 250 gm. linseed cake. In addition sheep No. 1 was given 60, 120, and 180 gm. of olive oil in the second, third, and fourth periods, respectively, and during the same periods No. 2 was given 50, 100, and 150 gm. olive oil. The coefficients of digestibility in the different periods were as follows:

Results of digestion experiments with sheep.

Period.		Sheep.	Dry matter.	Protein.	Fat.	Crude fiber.	Nitrogen-free extract.	Ash.
			Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
1	Meadow hay and linseed cake	No. 1	64.02	70.25	73.95	60.83	65.90	39.16
	Do	No. 2	63.20	68.77	72.83	61.84	65.38	32.42
2	Meadow hay, linseed cake, and olive oil	No. 1	63.50	70.00	80.90	60.71	62.80	34.47
	Do	No. 2	65.22	70.72	82.38	61.92	64.50	38.24
3	Meadow hay, linseed cake, and olive oil	No. 1	67.77	72.90	87.38	64.43	64.05	43.83
	Do	No. 2	62.94	68.72	86.21	61.06	57.16	34.27
4	Meadow hay, linseed cake, and olive oil	No. 1	64.11	70.78	88.78	66.87	53.07	37.28
	Do	No. 2	66.50	71.85	90.26	68.05	56.73	35.71

The fat (oil) was well assimilated even when the largest amounts (150 and 180 gm.) were consumed. The addition of fat to the ration did not, in the author's opinion, materially affect the digestibility and assimilation of the several nutrients.

The feeding value of corn stover, J. B. LINDSEY (*U. S. Dept. Agr. Yearbook 1896, pp. 353–360*).—The author discusses the composition, digestibility, etc., of corn stover, and gives practical suggestions for feeding it. The following conclusions are reached:

"(1) Both chemical analysis and digestion experiments show that corn stover contains fully as many pounds of actual food materials as equal quantities of the best grades of hay.

"(2) The blades, husks, and stalks are all valuable for food; hence the entire plant should be cut when the corn is ripe, carefully cured, and housed.

"(3) One-third to one-half of the stover is very often wasted by improper methods of treatment and feeding.

"(4) In order that it be eaten clean, corn stover should be cut fine or shredded before being fed.

"(5) Stover very frequently lacks in flavor and is a one-sided or carbonaceous feed; hence it should not be fed alone.

"(6) Only about one-half of the total coarse fodder of the ration should consist of stover. It should also be fed in combination with by-products rich in protein.

"(7) The palatability of stover can be improved by moistening with water and sprinkling with bran. Steaming very much improves the mixture."

Analyses of wild prairie hay, F. W. WOLL (*Wisconsin Sta. Rpt. 1896, pp. 305–307*).—Analyses are given of 4 samples of wild prairie hay. Samples 1 to 3 represent the ordinary upland prairie hay of this region, and consisted largely of Western wheat grass (*Agropyrum glaucum*), with needle grass (*Stipa comata*), and prairie June grass (*Koeleria cristata*). Small quantities of wild sage and grama grass were also found. Sample 4 consisted of Buffalo grass (*Bulbilis dactyloides*). The analyses are as follows:

Composition of wild prairie hay.

	Water.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Sample 1, cut July 25	6.19	6.58	3.05	45.34	28.32	10.52
Sample 2, cut September 4	6.46	4.66	3.09	46.40	28.80	10.59
Sample 3, cut January 10	7.63	3.15	4.12	45.89	29.24	9 97
Sample 4, cut January 20	7.34	4.44	2.03	50.07	24.22	11.80

The amid nitrogen constituted 12.9 per cent, 11 per cent, and 14.1 per cent of the total nitrogen of samples 1, 2, and 4, respectively. None was found in sample 3.

Influence of breeding on the feeding qualities of lambs, J. A. CRAIG (*Wisconsin Sta. Rpt. 1896, pp. 59–65, pl. 1, figs. 6*).—A test was made with 2 lots of lambs, mostly grade Shropshires, to test the influence of breeding.

Lot 1 was made up of 25 lambs. They were purchased in northern Wisconsin and no care had been taken in the selection of stock for breeding. The lambs had indifferent care from birth. Lot 2 was made up of 12 lambs. They were average wethers selected from the station flock and had been bred with care. Both lots were fed a ration of corn and peas 1:1, with corn fodder *ad libitum.* The test lasted 8 weeks. The financial statement is based on corn fodder at $4 per ton and corn and peas at 30 cts. and 45 cts. per bushel, respectively. The average weight of the lambs at the beginning of the test was for lot 1 75.5 lbs. and for lot 2 115.9 lbs. The amounts of food consumed, daily gain, and cost per pound of gain are shown in the following table:

Results of feeding grain to lambs.

	Food consumed.			Daily gain.	Cost per pound of gain.
	Corn fodder.	Corn.	Peas.		
	Pounds.	*Pounds.*	*Pounds.*	*Pound.*	*Cents.*
Lot 1 (northern lambs)	1.83	0.87	0.87	0.32	4.58
Lot 2 (station lambs)	2.41	1.26	1.26	.51	4.08

The daily gain of the station lambs was nearly twice as great as that of the northern bred lambs. They ate more food and the gains were more cheaply made. The lambs were estimated to be worth 3 cts. per pound at the beginning of the test and 4 cts. at the close. The profit per head on the northern lambs was 65 cts. and on the station lambs $1.13.

In the author's opinion the test showed that care in breeding is profitable. The author discusses what constitutes good condition from the market point of view, and the influence of condition and weight on market price. The northern lambs when purchased were, in the seller's opinion, ready for market, yet they were profitably fattened at the station for 8 weeks, and in the author's opinion could have been profitably fed for several weeks longer.

Farm grains for fattening lambs, J. A. CRAIG (*Wisconsin Sta. Rpt. 1896, pp. 53–58*).—This test, which was a continuation of work previously reported in the Annual Report of the station for 1895 (E. S. R., 8, p. 714), was made with 100 grade Shropshire lambs, to test the feeding value of corn, oats, and peas in various combinations. The lambs were divided into 4 equal lots. All were fed corn fodder *ad libitum.* In addition lot 1 was given corn, lot 2 corn and oats, lot 3 corn and peas, and lot 4 corn, oats, and peas. The lambs were not in good condition when purchased. On arrival at the station they were dipped, and those which had not already undergone the operation were docked. The financial statement is based on corn fodder at $4 per ton and corn at 30 cts., oats at 20 cts., and peas at 45 cts. per bushel.

The test began January 9 and extended over 8 weeks. The average weight of the lambs at the beginning of the test was 75.4 lbs. The average weekly gains per head were as follows: Lot 1, 1.9 lbs.; lot 2, 1.76 lbs.; lot 3, 2.27 lbs.; and lot 4, 1.9 lbs. The average cost per pound of gain for the lots was 4.37 cts., 5.15 cts., 4.58 cts., and 5.58 cts., respectively. The results of the previous test are quoted at length. From all the work the following conclusions were drawn:

The best gains were made on corn and peas, and the gains were more cheaply made than on any ration except corn. Adding oats to the ration had very little influence on the gain, while it materially increased the cost. When corn was the only grain fed it was found that the lambs were apt to lose their appetite, though digestive disorders were not observed.

"No losses were experienced either from the docking or the dipping. If the lambs had not been treated in this way, it is certain that they would not have made much progress in feeding and they would not have brought a remunerative price because of their appearance when put on Chicago market."

Grain feeding lambs for market, J. A. CRAIG (*Wisconsin Sta. Rpt. 1896, pp. 17–52, pls. 6*).—The author reports an experiment with 2 lots of lambs to compare feeding grain from birth and feeding it during the fattening period. He quotes the results of previous work at the station reported in Bulletin 41 (E. S. R., 6, p. 661). From all the experiments general deductions are drawn. The present test lasted 26 weeks. Lot 1 (4 lambs), fed grain from birth, weighed on an average 96.3 lbs. at the beginning of the test and gained 3.8 lbs. per week. Lot 2 (4 lambs), fed grain during the fattening period, weighed 88 lbs. at the beginning of the test and gained 3.44 lbs. per week. The grain consisted of a mixture of oats, corn, and linseed meal.

Among the conclusions drawn from this and previous experiments are the following: The greatest gains were made when lambs were fed grain before weaning. The rate of gain in the period after weaning was less than in any other period, though the cost of a pound of gain was less than during the third or fattening period. When lambs were fed grain after weaning they ate less when at pasture; one-half pound of grain per head daily was the greatest amount it was found profitable to feed. The feeding of such grains as oats, bran, or linseed meal and corn meal before and after weaning did not influence the rate or cost of gain to any appreciable extent during the 3 months of winter fattening when the lambs were being prepared for the early spring market. Feeding grain continuously from birth until the lambs were about 10 months old did not produce any noticeable difference in the relative amount of fat and lean, though the carcasses were somewhat heavier than when no grain had been fed previous to the fattening period. The lambs fed grain continuously from birth until 10 months old gave a heavier fleece of washed and unwashed wool and the fleece contained more oil than when grain was fed only during the fattening period. Continuous grain feeding materially influenced the early maturity of the lambs. In all the trials the lambs fed grain from birth weighed as much several weeks before the end of the test as the others at the close.

If lambs are sold in the summer at the age of 3 or 4 months it is profitable to feed grain before weaning. If they are sold in the fall when about 7 months old it will pay to feed grain both before and after weaning. If they are sold at 10 months old, after being fattened for 2 or 3 months during the winter, grain feeding before or after weaning has no appreciable influence on the profits.

Lambs fed grain from birth are fit for market at any time and advantage may be taken of favorable prices. In the author's experience during several years the most profitable time to sell lambs is before weaning, and in order that the greatest profit may be realized he has found it best to feed grain from birth.

Corn vs. corn meal for hogs, W. A. HENRY (*Wisconsin Sta. Rpt. 1896, pp. 10–16*).—Two tests were made to compare the relative value of whole corn and corn meal. The first test was made with 2 lots of 9 pigs about 15 months old. Each lot contained 5 pure-bred Poland Chinas and 4 Berkshire-Poland Chinas. Five were sows and the remainder barrows. During the summer preceding the trial, the pigs had been kept on pasture. They were fed corn and shorts for a short time previous to the beginning of the test proper, which lasted 10 weeks. Lot 1 was fed shelled corn and shorts and lot 2 corn meal and shorts. The corn used was 2 years old and contained 12.16 per cent of water. It was fed dry. The corn and shorts were mixed with water to a thick mush before feeding. Lot 1 at the beginning of the test weighed 3,190 lbs. and gained 1,235 lbs. Lot 2 weighed 3,113 lbs. at the beginning of the test and gained 1,348 lbs. Lot 1 consumed 3.96 lbs. of shelled corn and 0.47 lb. of shorts per pound of gain and lot 2 4.3 lbs. of corn meal and 0.51 lb. of shorts.

The second trial was made with 2 lots of 10 pigs each. Lot 1 was made up of 4 pure-bred Berkshires, 4 Berkshire-Poland Chinas, and 2 grade Poland Chinas. Four of the pigs in this lot were sows and the others barrows. Lot 2 was made up of 4 Berkshires and 6 Berkshire-Poland Chinas; 5 were sows and 5 barrows. All the pigs were about 6 months old at the beginning of the test. They had previously been fed corn meal and shorts. During the trial the rations were similar to those fed in the first trial. Some of the pigs had the run of a rape field also. The test lasted 10 weeks. Lot 1 weighed 2,254 lbs. and lot 2, 2,232 lbs. at the beginning. The gain of the respective lots was 789 lbs. and 1,076 lbs. Lot 1 consumed 4.22 lbs. of shelled corn and 0.65 lb. of shorts per lb. of gain; and lot 2, 5.02 lbs. of corn meal and 0.89 lb. of shorts. The author points out that, in the first trial with hogs in thin flesh at the beginning, 8 per cent of corn was saved by grinding. In the second trial, with light hogs rather fat at the beginning, 17.6 per cent of corn was saved by grinding. Considering the larger saving of 17.6 per cent, the author calculates the amount saved by grinding with corn at different prices to be as follows: With corn at 28, 35, and 42 cts. per bushel, the grain saved by grinding was worth 4.9, 6.1, and 7.4 cts., respectively.

In the author's opinion, the advisability of grinding depends upon its cost.

Ancient Egyptian bread, L. WITTMACK (*Sonder-Abdruck Sitzber. Gesell. Naturf. Freunde, Berlin, 1896, No. 5; abs. in Bot. Centbl., 71 (1897), No. 9, p. 328*).—The author made a microscopical examination of Egyptian bread 4,400 years old. The bread was made from ground barley, and the remains of yeast cells and other bacteria would seem to indicate that it was fermented. Bacteria similar to the butyric acid bacteria were particularly noticeable. The starch was largely gelatinized. Unchanged starch grains were, however, found which gave the characteristic reaction with iodin.

Report on food products, A. W. OGDEN, A. L. WINTON, and E. H. JENKINS (*Connecticut State Sta. Rpt. 1896, pp. 1–79*).—Reprint of Bulletin 123 of the station (E. S. R., 8, p. 508).

The composition of prepared cereal foods, E. E. SLOSSON (*Wyoming Sta. Rpt. 1897, pp. 71–84*).—Reprint of Bulletin 33 of the station (E. S. R., 9, p. 472).

The African kola nut, E. HECKEL (*Les Kolas africains. Paris: Société d'Editions Scientifique, 1896, pp. 406, pls. 3, figs. 46; rev. in Jour. Hyg., 22 (1897), No. 1098, p. 478*).—The author discusses the botany and chemistry of the kola nut, as well as its pharmaceutical preparations and its use in therapeutics. Experiments are summarized in which it was used by soldiers as a stimulant or food in cases of fatigue or when special muscular effort was required.

Composition of feeding stuffs, F. W. WOLL (*Wisconsin Sta. Rpt. 1896, pp. 309–320*).—Analyses are given of some of the more common feeding stuffs, feeding standards are quoted, and brief directions given for preparing rations.

The value of meat extract as a food and as a condiment, C. VOIT (*München. Med. Wchnschr., 44 (1897), p. 219; abs. in Vrtljschr. Chem. Nahr. u. Genussmtl., 12, No. 2, p. 158*).

The salt content of eggs preserved in brine of different strength, W. HANNA (*Arch. Hyg., 30 (1897), No. 4, pp. 341–347*).—The results of a number of analyses are given.

Studies on the chemical changes which take place in the body of a normal animal, M. KAUFFMANN (*Arch. Physiol. Norm. et Pathol., 5. ser., 8, p. 329; abs. in Jahresber. Agr. Chem., 19 (1896), p. 517*).—Experiments were made with dogs. The consumed oxygen, excreted carbon dioxid, nitrogen in the urine, and heat produced were determined. The formation of fat from protein is discussed.

Experiments with pigs, E. MEISSL (*Chem. Ztg., 21 (1897), No. 73, p. 731*).—In a brief note the author reports the results of pig feeding experiments in which a respiration apparatus was employed. Sugar and molasses were compared with starch as part of a ration. In the author's opinion the experiments showed that equivalent quantities of sugar and starch do not have the same feeding value. This is not in accord with theory. Sugar hindered slightly the gain of muscular and fatty tissue. In the author's opinion this was due to some secondary effect of the sugar.

Some standard varieties of chickens, G. E. HOWARD (*U. S. Dept. Agr., Yearbook 1896, pp. 445–470, figs. 18*).—This is a reprint from Farmers' Bulletin 51 (E. S. R., 9, p. 378).

Oyster culture in Europe, G. ROCHE (*Rev. Sci. [Paris], 4. ser., 8 (1897), No. 18, pp. 552–557*).—This is an extract from a work by this author entitled *La Culture des mers en Europe: piscifacture, pisciculture, ostreiculture.*

DAIRY FARMING—DAIRYING.

Frozen milk (*Milch Ztg., 26 (1897), No. 33, p. 527*).—In this note from the *Journal d'Agriculture* it is stated that the method of Casse for transporting milk in a frozen state has been adopted by the Danish dairy company. This company has an establishment about 100 miles from Copenhagen in which 30,000 liters of milk can be handled daily. From one-fourth to one-third of the whole amount of milk is frozen artificially in cakes of about 12 kg. in weight and placed in large cans of about 500 liters capacity. The following morning the cans are filled with fresh milk and are then closed air-tight and sent to Copenhagen. They can be kept in this way for several weeks, being opened for consumption at will. When it is desired to use the milk it is thawed by placing the contents of the cans in vessels surrounded by hot-water coils. The gradual thawing creates currents in the milk which prevent any of the constituents separating out. A can which had been put up June 17 was opened in Paris June 25. The milk had all the characteristics and taste of pure, fresh milk. The composition was the same as that of pure milk, but the keeping quality of butter made from it was, for some reason, unsatisfactory.

Frozen milk (*Apoth. Ztg.; abs. in Milch Ztg., 26 (1897), No. 40, p. 638*).—In experiments at the Hamburg Hygienic Institute about 30 liters of skim milk was completely frozen by placing in cold storage for 72 hours and was then gradually thawed out without mixing the contents of the can. Samples were taken from the top and bottom of the can, and the whole quantity was then thoroughly mixed and sampled. The analyses of these samples are given as follows:

Analyses of frozen milk.

	Specific gravity at 15° C.	Total solids.	Fat.	Specific gravity of milk serum at 15° C.
		Per cent.	*Per cent.*	
Sample from top of can	1.0061	1.70	Trace.	1.0045
Sample from bottom of can	1.0375	9.84	0.20	1.0285
Mixed frozen milk	1.0355	9.40	.15	1.1274

As the milk melted, the ice collected on the surface and its contents after thawing did not mix with the rest of the milk.

Conditions affecting the consistency of milk, S. M. BABCOCK and H. L. RUSSELL (*Wisconsin Sta. Rpt. 1896, pp. 73–80, pls. 2, fig. 1*).—It is mentioned that milk and cream are rendered thinner by heating, but unlike most viscous substances the original consistency is not restored when they are cooled. This is a serious objection to the use of pasteurized milk and cream. The authors made microscopic examinations with a view to determining the cause of this. Some of the results of these examinations are figured.

"A microscopic examination of pasteurized milk or diluted pasteurized cream presents a very different picture from that of normal milk or cream. In the case of the normal milk the fat globules in place of being homogeneously distributed throughout the microscopic field are grouped in part in irregular, but well-defined masses. All of the fat globules are not included in these fat aggregations. Some of the globules remain isolated and distinct. . . .

"The microscopic appearance of milk or cream that has been heated above 65° C. (149° F.) is totally different. Not only is this true with pasteurized milk, but sterilized or boiled milk as well as condensed milk likewise presents a similar microscopic appearance. In these cases the fat globules are homogeneously distributed throughout the miscroscopic field. The fat aggregations that are so characteristic of the preparations of normal milk and cream are here entirely lacking."

This difference in the microscopic appearance of pasteurized milk and cream was verified by hundreds of preparations of milk and cream from different sources.

It was found by combining the microscopical and viscometrical tests that the change in consistency occurred at practically the same temperature at which the microscopic clots in the milk broke up. This change occurred between 59 and 65° C., depending upon the varying condition of the milk. "This relation seems to show that the greater consistency of natural cream is very intimately connected with the presence of these fat aggregations. In milk this is less pronounced, owing to the greater effect that the serum solids have upon the total consistency of the fluid."

The observations were extended to colostrum, and to the effect of centrifugal force and of acids and alkalies on the consistency of milk and cream. It was found in every case that in cream raised by a separator the tendency toward grouping of the fat globules was greatly reduced, "the fat globules often being as homogeneously distributed as in pasteurized cream."

On the restoration of the consistency of pasteurized milk and cream, S. M. Babcock and H. L. Russell (*Wisconsin Sta. Rpt. 1896, pp. 81–94, figs. 3*).—Continuing the investigations noted in the preceding article, experiments were made with a view to restoring the consistency of pasteurized products by some artificial means. For this purpose the addition of finely divided egg albumen, tricalcium phosphate, and blood fibrin were tried with only partial success. It was found that infinitesimal quantities of rennet (1 : 200,000 parts or less) were sufficient to restore the consistency of cream in a few hours so that cream containing only about 12 per cent of fat whipped easily in a few minutes, while it was impossible to whip the same cream untreated. The action of rennet, however, continued with sufficient rapidity, even at refrigerator temperature, to cause the cream to thicken in the course of time.

"The development of acid with the increasing age of the milk constantly accelerated this curdling effect. The effect of acid upon rennet is to increase its rate of action, and on this account the gradually increasing acidity of milk makes it impossible to sufficiently retard it for practical purposes. Numerous experiments were also made with pepsin, which was found to be even more suitable than rennet, as its presence could in no way be detected by taste or smell.

"The addition of this enzym might have practically solved the problem had it not been for the fact that its rate of action, like that of rennet, is continually increased by the biological changes that occur in the milk even at low temperatures."

In experiments with pancreatin, trypsin, and the vegetable ferment papäin, it was found that undesirable by-products were formed, rendering them unsuitable.

"Incidentally, it was observed in experimenting with calcium hydrate that the pasteurized cream that had been treated with pepsin was immediately thickened. Noting this fact, calcium hydrate was used without the pepsin and the same result obtained. This effect was produced before the milk was rendered alkaline, thereby avoiding any undesirable taste. Extensive experiments were made with limewater, and while it was found that the result was uniformly successful, yet on account of the low solubility of lime, it was necessary to use so much that the milk solids were materially reduced. . . .

"The next problem was to secure a lime solution sufficiently concentrated to produce the desired effect without materially changing the composition of the milk. The combination of lime with cane sugar, forming sucrate of lime, furnishes a compound entirely suitable for this purpose. . . .

"The microscopical and physical characteristics of milk and cream treated with calcium sucrate simulate so closely those found in normal milk that we are led to infer that in this way we have restored a consistency similar in character to that of normal milk."

The preparation and use of viscogen (calcium sucrate) is described the same as in Bulletin No. 54 of the station (E. S. R., 9, p. 181).

Relation between cheese swelling and water, A. KÖSTER (*Mitt. Landw. Inst. Univ. Leipsic; abs. in Milch Ztg., 26 (1897), No. 42, p. 669*).—The cheese made from the milk produced on a large estate was found to swell abnormally. In studying the cause of the swelling the air and water and the fresh milk of each cow were examined. The cause of the difficulty was found to lie in the water used in the dairy. Small quantities of water added to sterilized milk gave the characteristic fermentation, and from such milk cultures could be made of a bacillus which when inoculated into fresh milk in turn produced the fault. The importance of bacteriological examinations from time to time of the water used in dairies and creameries is emphasized, and the method of making such examinations is described.

The increase of the yield of cheese by means of soluble lime salts, P. HILLMANN (*Inaug. Diss. Leipsic, 1896; Mitt. Landw. Inst. Univ. Leipsic, 1897; abs. in Milch Ztg., 26 (1897), No. 38, pp. 602, 603*).—In an inaugural dissertation (E. S. R., 8, p. 174) the author pointed out that the amount of paracasein precipitated from milk by rennet was increased by the addition of calcium chlorid to milk, and announced his purpose of carrying on practical experiments to determine whether the proportion of curd could be increased by this means. The present paper reports briefly some practical experiments in this line.

In each series of experiments the lime salts were added every other day to compare the results with those when no lime was added. The addition of lime gave more favorable results in the case of cows advanced in milk than of fresh cows, since the milk of the latter contains normally a higher percentage of soluble lime salts. Both calcium chlorid and monocalcium phosphate were used. The latter gave the greater increase in paracasein, as shown by the following averages:

Increase with monocalcium phosphate, 0.15 kg. of cheese per 100 liters of milk.
Increase with calcium chlorid, 0.30 kg. of cheese per 100 liters of milk.

Concerning the amount of lime salts to be added, it was found that the largest increase was obtained with the addition of 0.01 per cent of calcium oxid to the milk, which is equivalent to 45 gm. of monocalcium phosphate, or 20 gm. of calcium chlorid, per 100 kg. of milk. The increase with lime salts disappears when the amount of rennet is correspondingly diminished. The value of the increase is placed at 2½ cts. per 100 kg. of milk for skim cheese and 8½ cts. per 100 kg. of milk for Emmenthaler cheese. On account of the higher price of monocalcium phosphate the author recommends the use of calcium chlorid in the case of skim cheese.

The author wishes his results to be regarded as preliminary and strongly urges that cheese factories make practical trials of the method. He gives detailed directions for the method of using the lime salts. The proper amount of lime salts is dissolved in about 1 liter of water and the solution added to the milk before adding the rennet. It is recommended to use larger amounts of salts in the milk of cows well advanced. As to the amount of lime to be added, the equivalent of 10 to 20 gm. of calcium oxid per 100 kg. of milk is recommended, and a table is given showing the amount of calcium oxid corresponding to different amounts of monocalcium phosphate and calcium chlorid.

It is suggested that the addition of lime may also be beneficial in working with milk which has been pasteurized at a high temperature and hence curdles less completely with rennet. Laboratory experiments in heating milk for 3 to 5 minutes at 85 to 90° with the addition of lime salts have shown that such milk curdled as well as before heating. By adding some sour milk prepared with pure cultures to such pasteurized milk it can be rendered suitable for cheese making.

On the cause of ripening of Emmenthaler cheese, E. VON FREUDENREICH (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), Nos. 9–10, pp. 231–235; 13–14, pp. 349–351*).—The author made experiments with *tyrothrix*, which is believed by Duclaux to be the chief cause of the ripening of cheese. Large quantities of these bacilli were introduced into the curd, but in a number of the experiments it was found that they rapidly disappeared as the cheese ripened.

The author next attempted to demonstrate the accuracy of his theory that the change in the casein in ripening cheese is due to lactic acid bacteria. He made experiments in skim milk with 3 different kinds of lactic acid bacteria. To determine the change in the casein the nitrogen found in portions of the cultures filtered through a porcelain filter was compared with the nitrogen in the filtrate from the control milk to which no culture was added. It was found in this way that culture A contained 2.4 times as much soluble proteids as the control milk, culture B 6.4 times, and culture C 5.1 times. This, the author states, shows that beyond doubt a part of the casein in the cultures B and C was changed to a soluble form. It was found that adding 0.5, 1, and 2 per cent of lactic acid to milk did not cause any perceptible change in the amount of soluble proteids, which leads the author to conclude that the change in the casein is not due to the action of the lactic acid produced in the fermentation. He reaffirms his former belief that the ripening of cheese is due largely and perhaps entirely to the action of lactic acid bacteria.

In the second paper the results of further experiments are reported. Cultures were made in skim milk as before, inoculating the milk with a mixture of one of the lactic acid bacteria formerly used isolated from ripening cheese. At the end of 4 weeks it was found that while the fresh filtered skim milk contained 0 033 per cent of nitrogen, the filtrate from the culture contained 0.156 per cent, "showing again that a part of the casein of the milk had been changed to soluble form." A chemical examination of the filtrate from the culture showed that the soluble proteids were for the most part in the form of amid nitrogen.

The author compares the extent of the change in the casein noticed by him in milk with that found by Bondzynski in Emmenthaler cheese, indicating that the change was somewhat greater in the case of the skim milk.

In conclusion the author says that considering that practically only lactic-acid-producing microorganisms are found in ripening cheese and that other bacteria, as *tyrothrix*, etc., occur only in numbers too small to mention, and furthermore that it has been shown that these lactic acid bacteria are able to decompose and dissolve the casein, it can hardly be doubted that these lactic acid bacteria are the cause of the ripening of hard cheese.

[The reason for the change in the casein noted in these experiments and attributed to lactic acid bacteria, whereas no change has been observed by other investigators when pasteurized milk was used, is probably to be found in the enzym recently discovered by Babcock and Russell to be a normal constituent of milk (see E. S. R., 9, p. 205).—ED.]

The rise and fall of bacteria in Cheddar cheese, H. L. RUSSELL (*Wisconsin Sta. Rpt. 1896, pp. 95–111, pl. 1, fig. 1*).—The methods of bacteriological analysis are described, especially those used in the investigations on cheese, which are given in considerable detail. In order to bring the sample of cheese into a finely divided state so that bacteria can develop, the cheese is triturated in a sterile mortar in contact with sand or sugar. It is then added to a known volume of sterile water and thoroughly shaken, which dissolves the sugar, leaving the bacteria in suspension in the emulsion of casein, fat, and water. Culture plates are made by adding to the gelatin 1, 2, or 3 drops of the cheese mixture by means of a pipette.

The results are tabulated of determinations of the number of bacteria per gram in 6 different Cheddar cheeses at different stages of the ripening process; and the number of those producing lactic acid and gas, digesting casein, and inert bacteria are given. These data are discussed at length and are shown graphically.

"The general results of this analytical study of the bacterial changes that take place in the curing of cheese may be briefly summarized as follows:

"(1) There is at first a marked falling off in the number of bacteria in green curds for a day or so. (Period of initial decline.)

"(2) This is followed by a very rapid increase in numbers, in which the bacteria reach scores of millions of organisms per gram. (Period of increase.)

"(3) This period is followed by a diminution in numbers, at first rapid but later more gradual, until the germ content sinks to insignificant proportions. (Period of final decline)

"(4) The time necessary to reach the maximum development (2d period) is hastened or retarded by such external conditions as temperature, etc.

"(5) The second period also marks the beginning of the physical change that occurs in the cheese in the earlier part of the breaking down of the casein.

"(6) The bacterial flora of cheese differs markedly from that of milk. In milk the lactic acid bacteria predominate, but accompanying them are always liquefying or peptonizing organisms, and as a rule bacteria capable of developing gaseous by-products.

"In the ripening cheese the peptonizing or casein digesting bacteria are quickly eliminated; the gas producing bacteria disappear more slowly, sometimes persisting in very small numbers for a long time.

"The lactic acid bacteria, on the other hand, develop enormously for a time, until the cheese is partially ripened, when they, too, begin to diminish in numbers.

"(7) The generally accepted theory that the peptonizing or digesting bacteria are able to break down the casein in the cheese as they do in milk is improbable, because this type of bacteria fails to increase in the cheese and usually disappears before there is any evidence of physical changes in the condition of the casein. The same is true where cheese is made from pasteurized milk to which copious starters of these peptonizing organisms have been added.

"(8) The coincidence existing in point of time between the gradual ripening of the cheese and the marked development of the lactic acid bacteria seems to indicate that these phenomena are causally related. This view is further strengthened by the fact that cheese made from pasteurized milk in which the lactic bacteria have been destroyed fail to ripen in the normal manner, while the addition of a pure lactic acid ferment to the pasteurized milk permits the usual changes to occur in a perfectly normal way."

Pure lactic cultures of bacteria in cheese making, H. L. RUSSELL (*Wisconsin Sta. Rpt. 1896, pp. 112–126*).—Four preliminary experiments were made with a pure culture of the lactic acid germ, control cheeses being made at the same time.

"The results attained so far showed that the use of the culture starter had one very great advantage in lessening the time of manufacture. Instead of waiting for the acid to develop naturally, a process sometimes requiring several hours, the addition of the pure lactic ferment brought the acid rapidly forward, so that the milk could be expeditiously handled."

These results led to a trial on a large scale at the university creamery. During the winter of 1895–'96 a large number of cheeses were made in which a pure lactic acid culture prepared from ripening cheese was used. In many cases control cheeses were made without the use of a starter. The cheeses were scored by a disinterested party, and the results are tabulated.

"On the whole the use of the lactic ferment improved not only the flavor of the cheese but the texture as well, where it was compared with cheese made with milk ripened without the addition of any starter. By making several cheeses from each batch of milk and taking an average score of these as representing the day's run, the lactic ferment cheeses score higher in flavor in three cases by 4.55 points, while in two instances the score of the control cheese without any starter exceeded the culture cheese by a sum of 1.5 points in flavor.

"In texture the culture cheese won in four cases out of five, having a higher sum total of 4.4 points, while the control cheese was 1.2 higher in one instance. . . .

"The culture cheeses were more uniform in quality than the control, as shown by less variation in flavor and texture of different cheeses made on the same day."

Some experiments made to compare the relative merits of Hansen's lactic ferment and the lactic ferment isolated by the author from ripening cheese showed practically no difference between the two.

Preliminary experiments are noted on the use of partially ripened cheese as a starter. When plugs of such cheese were incubated in sterile milk it was found that traces of gas were almost sure to develop, showing that the gas-producing organisms were not entirely extinct. The conditions seemed to be favorable for the development of the gas-producing bacteria as well as the pure lactic organisms. Experiments are to be continued on this subject, but at present the station does not recommend the use of partially ripened cheese for a starter. The details are given for using lactic starters in cheese factories.

Moisture supply in cheese-curing rooms, J. W. DECKER (*Wisconsin Sta. Rpt. 1896, pp. 156–163*).—A comparison is given of the wet and dry bulb thermometer with a commercial hygroscope showing that the latter "is only approximately correct." A table is calculated showing the relative humidity corresponding to the readings of the wet and dry bulbs.

In order to maintain the requisite amount of moisture in the curing room, containing 5,000 cu. ft., experiments were made, using cloths hung in the room and kept moist.

"As we now have the apparatus perfected, the cloths are supplied with water from a ¾-inch water pipe that runs along the top of the room. Very small holes were drilled about 6 in. apart on the upper side of the pipe. Strips of cotton cloth were hung over this pipe and when the water was turned on it went through the holes, wet the cloths and flowed down through them. The flow of water through the pipe was regulated by a valve so that it would drip slowly from the bottom of the cloths. Under the cloths was a tray 1 ft. wide and 4 in. deep for catching the dripping water and carrying it off into a drain. After adjusting the valve we were able to keep a steady flow through the sheets for 2 weeks. . . .

"If there is sufficient room for it, we believe double the surface of cloth, or 200 sq. ft. to 5,000 cu. ft. of space will be none too much."

Test of dairy cows, J. W. DECKER (*Wisconsin Sta. Rpt. 1896, pp. 164, 165*).—The results are given of tests of 2 cows from a Holstein herd for 7 days and 7 cows from a Guernsey herd for 2 days. In these tests the yield of milk and the percentage and total amount of fat were determined.

"Johanna Rue, one of the Holsteins, made the remarkable record of 2.96 lbs. of butter fat in 24 hours, while 2 cows in Mr. Hill's [Guernsey] herd scored over 2 lbs of fat in the same length of time. One of these cows it must be noted was a native."

Record of Jersey and Guernsey cows at the academical farm at Bonn-Poppelsdorf, E. RAMM (*Milch Ztg., 26 (1897), Nos. 31, pp. 487–489; 34, pp. 539, 540, figs. 4*).—The record for one period of lactation is summarized for 6 Jersey and 5 Guernsey cows. The cows were tested especially for the production of milk for infants.

The results were quite satisfactory as to quality and quantity of milk. The average for the Jerseys was 5.33 per cent and for the Guernseys 4.54 per cent of fat. The average yield was 18.63 and 18.19 kg., respectively, per 1,000 kg. live weight, for each day the cows were milked. The detailed records for 1 Jersey and 1 Holstein are given for the period of lactation.

Comparison of the Babcock test and the gravimetric method of estimating fat in skim milk, E. H. FARRINGTON (*Wisconsin Sta. Rpt. 1896, pp. 138–143, figs. 2*).—A reprint from Bulletin 52 of the station (E. S. R., 8, p. 932).

Table for rapid and safe determination of the dry matter in milk from the specific gravity and fat by Fleischmann's formula, M. M. CRAANDIJK (*Milch Ztg., 26 (1897), No. 28, pp. 440–444*).

The alkaline tablet test of acidity in milk or cream, E. H. FARRINGTON (*Wisconsin Sta. Rpt. 1896, pp. 144–155, figs. 3*).—A reprint from Bulletin 52 of the station (E. S. R., 8, p. 933).

Detection of watered milk by the nitrate test, M. RIEGLER (*Rev. Internat. Falsif., 1897, No. 4; abs. in Milch Ztg., 26 (1897), No. 36, p. 574*).—It is proposed to detect the addition of water to milk by means of the test for nitrates on the supposition that milk contains no nitrates or nitrites.

[This means was suggested several years ago by Richmond (E. S. R., 5, p. 644), who afterwards found that when small doses of saltpeter were given to cows their milk gave a strong reaction for nitrates. It was believed cows might take enough nitrates in the drinking water on some farms to give the nitrate test in their milk.—ED.]

Plan for uniformity in methods of food control (*Milch Ztg., 26 (1897), No. 38, pp. 605, 606*).—The methods proposed by the commission appointed at the instance of the Imperial Health Office of Germany are given for the analysis of milk and examination for adulterants, admixtures, preservatives, etc.

The advantages of cooperative establishments for supplying milk to cities, J. SIEDEL (*Milch Ztg., 26 (1897), Nos. 34, pp. 535, 536; 35, pp. 551, 552; 36, pp. 567–569*).

The creamery at Windsor Park, England (*Milch Ztg., 26 (1897), No. 34, pp. 536, 537, figs. 2*).

Murchland's milking machine (*Milch Ztg., 26 (1897), No. 28, pp. 439, 440, fig. 1*).

Recent experiences with the Thistle milking machine, WEITZEL-LANGEN (*Milch Ztg., 26 (1897), Nos. 27, pp. 425, 426; 32, pp. 504, 505*).

Microorganisms in the dairy industry, N. BENDIXEN (*Milch Ztg., 26 (1897), No. 29, pp. 455, 456*).—A semi-popular article.

The employment of commercial cultures in butter making, DORNIC (*Milch. Ztg., 26 (1897), No. 29, pp. 462, 463*).—General remarks on the use of the pure cultures or starters put up commercially, and a few experiments in their use. The conclusion is reached that the use of these cultures should be confined to creameries or dairies which make butter of poor or only fair quality. Creameries which already make a product of uniformly high quality are advised not to adopt the commercial cultures.

Care of dairy utensils, R. A. PEARSON (*U. S. Dept. Agr. Yearbook 1896, pp. 431–444*).—This popular article deals with the necessity for cleanliness in successful dairy work, the selection of dairy utensils, methods, appliances for cleaning and sterilizing dairy utensils, the care and cleaning of dairy rooms or buildings, clothing of operators, etc. In purchasing dairy utensils it is recommended to select only such as can be easily cleaned.

"Other things being equal, the more accessible the inside surface of an article for dairy use the more valuable it is. Any having corners or parts which can not be easily reached with water and a brush or cloth should be avoided. A vessel should be discarded if it has sharp, angular corners, unless they are absolutely necessary, for they require too much attention. All dairy utensils should be of hard material and have smooth surfaces. Wooden pails should never be used for holding milk, as in the surface of the wood there are numberless small pores and fissures. . . .

"The joints and rims should be made smooth and the cracks entirely filled with solder. Cheap tinware is put together so carelessly that the joints are often rough and uneven, and little projecting points of solder make it difficult to move the cleaning cloth along the seam. Pails and other circular tin vessels should have but one seam on the sides; better ones are made without a seam.

"It is important to keep the outside of utensils clean. In order to facilitate the work, the outer surface should be so finished that every part can easily be reached by water and cloth. The outside of tinware should be finished as smoothly as the inside, and all wood apparatus should be carefully finished on the outside, being made smooth and having as few projecting nuts, rods, and braces as possible."

Concerning the advisability of requiring creameries to pasteurize their skim milk and buttermilk and to burn their separator slime, NEUMANN (*Milch Ztg., 26 (1897), No. 32, pp. 505–507*).—The subject is considered *pro* and *con*—the prevention of the spread of diseases, added expense to creameries, etc.; and it is considered hardly practicable at present.

A new method of making butter (*French Patent No. 258234; abs. in Milch Ztg., 26 (1897), No. 33, p. 526*).—In this process the fresh cream is subjected to lactic acid fermentation until the fat globules are inclosed in a sufficiently strong covering of casein, when the cream is heated, carbonic acid conducted into it without sufficient agitation to churn the cream, and finally submitted to alcoholic fermentation. This fermentation changes the character of the cream, allowing the fat globules to rise to the surface, while the other ingredients remain behind. Churning in the ordinary sense is said to be unnecessary, as the butter fat collects on the surface and it is only necessary to wash it to free it from small particles of casein adhering to it.

Factory cheese and how it is made, G. MERRY (*U. S. Dept. Agr., Bureau of Animal Industry Circ. 19, pp. 8*).—This is a reprint from U. S. Dept. Agr., Bureau of Animal Industry Bulletin 15 (E. S. R., 9, p. 89).

Plans of building and methods of conducting cheese factories and creameries, H. H. DEAN (*Ontario Agl. Col. and Expt. Farm Special Bul., May, 1897, pp. 32, figs. 16*).—A popular bulletin.

Asses' milk, A. SCHLOSSMANN (*Ztschr. Physiol. Chem., 23 (1897), No. 3, pp. 258–264*).—Analyses covering a period of over 1 month are given, together with various studies on the characteristics of the milk and its constituents in comparison with those of the milk of other animals.

Asses' milk and the nutrition of infants, KLEMM (*Jahrb. Kinderheilkunde, 43, No. 4; abs. in Milch Ztg., 26 (1897), No. 40, p. 638*).—The author recommends the use of asses' milk for young children on the ground that it corresponds to human milk more closely than the milk of any other animal and asses are not subject to tuberculosis. Asses' milk is said to contain 1.46 per cent of albumin, 0.4 per cent of ash, 6.2 per cent of sugar, and 1.38 per cent of fat. Practical experience with the use of asses' milk is said to have been very favorable on both healthy and delicate children. The greatest hindrance to its more extensive use is believed to be the high price, the dairy in Dresden charging from 2.1 to 3 marks per liter (about 50 to 75 cts. per quart).

Dairy statistics for the Grand Duchy Mecklenburg-Schwerin for the year 1896, J. SIEDEL (*Milch Ztg., 26 (1897) No. 42, pp. 665–667*).

Dairying in Russia (*Milch Ztg., 27 (1897), No. 32, pp. 503, 504*).

List of officials and associations connected with the dairy interests in the United States and Canada for 1897, H. E. ALVORD (*U. S. Dept. Agr., Bureau of Animal Industry Circ. 18, pp. 8*).—This list includes State dairy officials, National and State dairy associations, with presidents and secretaries, and dairy officials in the Dominion of Canada.

VETERINARY SCIENCE AND PRACTICE.

The country slaughterhouse as a factor in the spread of disease, C. W. Stiles (*U. S. Dept. Agr. Yearbook 1896, pp. 155–166*).—This article is based upon the inspection of the slaughterhouses of 2 States. Although definite figures can not be given for the State, it was found that the number of such houses varies in different towns from 1 to 72 to 1 to 1,600 inhabitants. The slaughterhouses found the author divides into 2 classes: Large abattoirs located in cities and local slaughterhouses used by meat dealers in country towns. The latter are not always owned by those who do their own killing.

In the majority of cases hogs are kept in connection with the slaughterhouses to dispose of the offal. Where houses are on the banks of a stream the offal is thrown out on the bank and left to be eaten by various animals, to rot, and drain into the river. Naturally slaughterhouses are centers of disease. Some of the animals killed are certainly diseased, and if the offal is fed to hogs these can not escape. Rats and dogs also are important factors. If the former are eaten by hogs trichinosis is a fairly certain result, as shown by the examination of 147 rats, showing over 27 per cent infected. If the slaughterhouse chances to be burned the rats wander away, carrying disease with them.

Besides trichinosis, tuberculosis, and the parasitic *Echinococcus hydatid*, which seems to be on the increase in this country, the thin-necked bladder worm, the gid bladder worm, and the tongue worm, swine plague, and hog cholera are apt to be spread by such feeding.

To obviate the dangers arising through offal feeding, drainage, rats, and dogs, the segregation of slaughterhouses and the control of the 4 factors concerned in spreading disease are advised. Offal feeding should be abandoned. The drainage should be perfect. Rats should be destroyed and dogs not allowed in the slaughterhouse. The buildings should be more substantial, the floor and the pavement of the yard should be of asphalt. Every local board of health should have a competent veterinarian, and the slaughterhouses should be licensed and be supervised by a veterinarian. The raising of stock, except horses, within the premises of such houses should be prohibited, and the farmer who kills his own beef should bury or burn the offal. It is on the farmer's account that such precautions are most necessary, since he is more subject to the dangers involved in the slaughterhouse than others.

The restriction of tuberculosis by isolation and the use of affected animals for breeding purposes, H. L. Russell (*Wisconsin Sta. Rpt. 1896, pp. 127–133*).—Some general remarks upon the subject are made and a record given of a series of experiments that are essentially a repetition of those of Prof. Bang of Denmark, as embodied in his report before the International Hygienic Congress of 1894 at

Buda Pesth. But in addition to the tuberculin treatment several animals were tested with Aseptolin.

The herd experimented upon was composed of high-grade Guernseys. Previous to the test 1 had developed a severe cough and grown thin, and later, together with another cow, developed tuberculosis. *Post-mortem* examination of both showed them to be badly affected. The remaining animals were apparently sound. On January 2, 1896, all were inoculated, 7 temperature readings being taken previous and 8 subsequent to the inoculation. As a result 16 of the 24 animals 1 year and more of age proved to be tuberculous and 8 sound; while all (16) of those under 1 year of age were declared perfectly healthy. The tuberculous animals were then separated from the healthy and given the best of care to see if nature would effect a cure. The animals were bred and the young nearly as soon as dropped tested with tuberculin, and if they passed the test successfully placed with the healthy animals. All calves from infected dams were fed on pasteurized milk. Abundant daily exercise was given both sections of the herd and intensive feeding carefully avoided. In the course of 6 months the herd was again subjected to the tuberculin test.

Several of the animals were given medical treatment with Edison's Consumptive Cure, Aseptolin. The dose was from 4 to 5 drams per animal but this was gradually increased in the tri-weekly injections until it reached 12 drams. Inhalations of carbolized glycerin were also given daily. Frequent tests were made for albumen, but it was found in but one instance. Twenty days after the beginning of the treatment it was remarked that the animals were apparently benefited by it. On the day following 1 animal died from exposure during parturition.

Five living calves were dropped during the course of the experiment. Four of them were from tuberculous cows, but none of them responded to the second tuberculin test to which the herd was subjected.

In this second test all animals that had previously responded reacted but their condition was such as to show that the disease had been checked. One of the animals treated with Aseptolin was killed and was found to be but slightly tuberculous.

From these facts the author concludes that the spread of the disease may be controlled and that at least some of the affected animals be used for breeding purposes, and that such treatment evidently possesses advantages over compulsory stringent legislation.

Some modern disinfectants, E. A. DE SCHWEINITZ (*U. S. Dept. Agr. Yearbook 1896, pp. 255–262, fig. 1*).—After a brief statement of the nature of disinfection and the comparative merits of several true disinfectants, *i. e.*, those that both kill the germs and destroy or counteract the odors arising from their growth, the author proceeds to briefly note steam and boiling water, which are recognized as the best disinfectants where applicable, carbolic acid, which still holds its place in spite of many substitutes that have been recommended, and several substitutes for carbolic acid (creolin, lysol, cresolin, cresin, solveol, and tricesol). Formic aldehyde is then considered somewhat more at length and a brief summary of the history of the knowledge of its importance as a germicide and disinfectant is given.

For practical purposes those methods of using the gas are thought best in which the gas is allowed to work in *statu nascendi*. With proper apparatus for generating gas, it is thought it might possibly be used successfully against insects injurious to vegetation.

Summarizing the subject, it is pointed out that formalin in the strength of 1:10,000 prevents the growth of tuberculosis, anthrax, cholera, typhus, pus, and diphtheria germs. A very weak gaseous form is sufficient to prevent growth. A 1 per cent solution of formalin kills pathogenic organisms in one hour. A 3 per cent solution with a final addition of alcohol may be used for rendering the hands germ free; but whether the skin is attacked in such use is uncertain. Spraying with formalin and a subsequent inclosure of articles will effectually sterilize them. Uniforms can be disinfected on a large scale without injury in 24 hours. A 1 per cent solution is sufficient to deodorize feces and in 13 minutes to render them germ free. Buildings, etc., may be disinfected by 1 to 1½ per cent, by volume, of the gas. Finally, formic aldehyde is a useful etching material and preservative. It is added further that the substance has the advantage over carbolic acid, lysol, etc., of not being retarded in its action by albuminoid matter and not injuring articles to which it is applied. A slight objection, that it adheres to clothing and upholstered goods, is met by stating that its odor may be removed by proper ventilation and by the use of dilute ammonia, which readily absorbs the gas. It has been found useful in preserving food, milk, etc., but its effects in this direction should be studied further before it is given a general recommendation. Used for ticks on cattle, it is found by the author that a calf exposed for 2 hours in an atmosphere of 2 per cent of the gas suffered no especial distress; there was only a slight watering of the eyes and an occasional cough, both of which disappeared upon bringing the animal to fresh air. Its use as a disinfectant of imported hides, owing to its rapid action and penetrating power, is thought worthy of high recommendation. With reference to the amount of wood alcohol to be employed in the disinfection of rooms, etc., by means of lamps for generating the gas, it is stated that 1 liter of the alcohol will, if all converted, produce 748 grams (361 liters) of the gas, which, in a room of 1,000 cu. ft. capacity, would give 1.26 per cent of the gas. Finally, it is stated that a 40 per cent solution of the gas can be obtained for one-fourth the price of formalin.

Prolonged gestation (*Chron. Agr. Canton Vaud, 10 (1897), No. 6, p. 177*).—Note is made of a mare that was covered on June 3 and 4, 1895, but did not foal until September 1, 1896, or for a period of 455 days—about 15 months.

Heredity color in horses, F. GALTON (*Nature, 56, No. 1460, pp. 598, 599*).—From a consideration of numerous data the conclusion is arrived at that the sire and the dam have almost an equal influence on the color of the offspring, and further that the number of observed cases, of red for example, corresponds with the calculated cases, the calculation being made according to the author's recent theory.

An anatomy of the horse, W. ELLENBERGER and H. BAUM (*Topographische Anatomie des Pferdes. Berlin: Paul Parey, 1897, vols. 3, pp. 951; rev. in Nature, 56, No. 1460, p. 586*).—The first volume (pp. 271) appeared in 1894 and deals with the limbs; the second volume (pp. 350) deals with the head and neck; and the third with the rest of the body. The work is well illustrated, many of the figures being colored. The nomenclature employed is largely that used in human anatomy.

Notes on the bacteriology of anthrax, C. C. DUNCAN (*Agr. Students' Gaz., 8 (1897), No. 4, pp. 103–108*).

On the demonstration of typhus bacillus and the bacteria of the typhus group in water, J. WASBUTZKI (*Ueber den Nachweis des Typhusbacillus und der Bacterien der Typhusgruppe in Wasser. Inaug. Diss. Königsberg, 1896; abs. in Ztschr. Wiss. Mikros. u. Mikros. Technik, 14 (1897), No. 1, pp. 113–115*).

Prof. Koch's new tuberculin, D. B. MASON (*U. S. Consular Rpts., 1897, June, pp. 219–225*).—A popular account of the new tuberculin, and its preparation and effects.

Tuberculin inoculations for the year 1896, H. L. RUSSELL (*Wisconsin Sta. Rpt. 1896, pp. 134–137*).—During the year 162 tuberculin inoculations were made on 6 herds made up for the most part of high-grade stock. As a result 22 of the 98 animals of one year of age and over were found infected, while none of the 34 animals under one year of age reacted. This result, however, the author thinks indicates a prevalence of the disease in the State greater than is actually the case.

On the use of "Chinosol" in veterinary practice, G. ZACHER (*Deut. Landw. Presse, 24 (1897), No. 50, pp. 462*).—A disinfectant compound sold by a German firm.

TECHNOLOGY.

The uses of peat in the preservation of ice (*Landw. Wchnbl. Schleswig-Holstein, 47 (1897), No. 41, p. 589*).—Short notes in which the value of peat in the conservation of ice is considered.

The manufacture of sorghum sirup, G. L. SPENCER (*U. S. Dept. Agr., Division of Chemistry Circ. 1, pp. 3*).—Brief directions are given for the manufacture of sorghum sirup on a small scale.

Action of the constituents of cider on fermentation, G. GELM (*Staz. Sper. Agr. Ital., 30 (1897), p. 294; abs. in Bul. Soc. Chim. Paris, 3. ser., 18 (1897), No. 22, p. 1248*).—The action of tannin, peptones, and tartaric acid was studied.

Sterilization of cider by means of formalin, G. GELM (*Staz. Sper. Agr. Ital., 30 (1897), p. 301; abs. in Bul. Soc. Chim. Paris, 3. ser., 18 (1897), No. 22, p. 1248*).—The use of 400 cc. of formalin per hectoliter is recommended as an effective means of sterilization.

On maize oil, W. DULIÈRE (*Ann. Pharm., 1897, p. 219; abs. in Vrtljschr. Chem. Nahr. u. Genussmtl., 12, No. 2, p. 194*).

The manufacture of peanut oil (*Chem. Rev. Fett u. Harzind., 1897, p. 27; abs. in Vrtljschr. Chem. Nahr. u. Genussmtl., 12, No. 2, pp. 194, 195*).

Textile raw materials and their use in the arts, J. ZIP (*Die textilen Rohmaterialien und ihre Verarbeitung zu Gespinsten. Vienna: Franz Deuticke, 1897, vol. 2, pt. 1, pp. XV, 166, figs. 144*).

AGRICULTURAL ENGINEERING.

Irrigation experiments, F. H. KING (*Wisconsin Sta. Rpt. 1896, pp. 189–204, figs. 4*).—Experiments in the same line as those of previous years (E. S. R., 8, pp. 689, 733) were carried out in 1896. The rainfall of the growing season (May 1 to August 31) of 1896, unlike that of 1894 and 1895, was not only fairly abundant (15.02 in.), but was generally well distributed. "This being true, the irrigation experiments have afforded excellent means for determining, under field conditions, how much moisture is really needed in the soil to insure maximum yields."

Experiments on potatoes, corn, clover, and cabbage are reported, with estimates of the cost and profit of irrigation by pumping.

Experiments with potatoes.—A plat of sandy clay loam, 87 by 287 ft., after a liberal application of well-rotted barnyard manure, was planted partly in Burbank potatoes, partly in Rural New Yorker potatoes.

"Flat cultivation was adopted until July 8, when the potatoes were ridged for irrigation. The whole plat of 115 rows was divided into alternating groups of 6 rows irrigated and not irrigated, separated by 1 row of potatoes irrrigated only on 1 side.

"The potatoes were irrigated on July 10, 21, August 3, 10, and September 3, receiving each time 2.15 in. of water, or in the aggregate 10.75 in. more than the rainfall."

The following table gives the yields per acre of the 2 varieties:

Yields of potatoes on irrigated and unirrigated plats.

	Rural New Yorker.			Burbank.		
	Large.	Small.	Total.	Large.	Small.	Total.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Irrigated	382.0	12.2	394.2	220.0	22.7	242.7
Not irrigated	280.3	10.2	290.5	141.5	16.2	157.7

Determinations of the specific gravity indicated that the irrigated potatoes were of as good quality as those grown on the unirrigated plats.

Experiments with corn.—This was a continuation of experiments of previous years (E. S. R., 8, p. 733), except that subirrigation was not practiced. The amount of water applied is not stated.

"The yield of dry matter on the irrigated ground has exceeded that on the ground not irrigated by about a ton to the acre, the average difference being 2,062 lbs., and if this is figured as corn fodder containing 15 per cent water it represents a gain of 1.213 tons per acre.

"When the comparison is made on the basis of kiln-dried shelled corn the results stand thus:

	Bushels.
Dent corn, irrigated, thinned to 2 stalks	51.2
Dent corn, not irrigated, thinned to 2 stalks	42.8
Difference	8.4
Flint corn, thick seeding, irrigated	51.9
Flint corn, thick seeding, not irrigated	29.6
Difference	22.3

Experiments with clover.—Two crops of clover were cut on an area of 5.83 acres, the second growth being irrigated. Two plats were irrigated June 18 and July 11, and two June 24 and July 13. All plats were also irrigated after the cutting of the second crop August 15 and September 10. The total amount of water applied varied from 5.19 to 8.97 in.

"From the 5.83 acres of ground were cut 19.14 tons of hay, containing 15.3 per cent water. The second crop this year on adjacent land not irrigated was 1 ton per acre, and using this as a basis of comparison the increase of the second crop due to irrigation averaged 2,071 lbs. per acre, or 12,074 lbs., equal to 6.04 tons on the 5.83 acres. To this should be added the third crop of pasturage, which exceeded 2 tons from the whole area, making the gain due to irrigation 8 tons in all."

Experiments with cabbage.—This is an account of a continuation of experiments of the previous year (E. S. R., 8, p. 689).

"The primary object of the cabbage experiment was to see if it is not possible to grow a larger number of good heads upon a given area where an abundance of water is applied at the right time by irrigation than is possible where the natural rainfall alone is depended upon. . . .

"The rows were all set 30 in. apart, and on one-half of the plat the plants were set 15 in. in the row and on the other 30 in. in the row, or at the rate of 13,939 and 6,969 plants per acre, respectively."

The actual stand per acre was 12,030 plants in case of thick setting and 5,470 in case of thin setting.

"A larger percentage of plants headed on the more open stand and also a slightly larger percentage on the not irrigated land than on that irrigated."

The cabbages were irrigated 4 times (July 21, August 3 and 10, and September 3), applying a little over 2 in. each time, or 8.25 in. in all.

The results per acre were as follows:

Average weight per head and yield per acre of cabbages.

	Firm heads.		Loose heads.		Leaves and stems (total).
	Average weight.	Total.	Average weight.	Total.	
Thin planting:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Irrigated	7.60	30,610	4.88	6,227	42,730
Not irrigated	6.95	29,480	4.23	4,624	49,220
Thick planting:					
Irrigated	5.13	46,590	3.23	7,688	64,100
Not irrigated	4.46	40,100	2.39	5,943	57,630

The cost and profit of irrigation by pumping.—An exact estimate of the cost of irrigation at the station could not be made because the plant was not used to its full capacity. Observations, however, showed that with a ton of coal costing $4 the plant raised 0.9248 acre-inch of water each hour a distance of 26 ft. at a cost of 16.74 cts. per hour for fuel.

"With coal costing 16.74 cts. per hour, and charging 15 cts. per hour each for engine, engineer, and water distributor, the cost per acre-inch would be 66.76 cts." Applying these figures to the above experiments it was found that "in spite of the very high cost of the water used there is still a decided balance in favor of irrigation in humid climates even for ordinary field crops such as corn ($2.16 per acre), potatoes

($11.70), and hay." With cabbage the balance in favor of irrigation was $2.43 in case of thin setting, $29 in case of thick setting.

The draft of corn harvesters, F. H. KING and L. H. ADAMS (*Wisconsin Sta. Rpt. 1896, pp. 205, 206, fig. 1*).—Tests of the draft of the McCormick and Deering self-binding corn harvesters indicated that "the team working the Deering corn harvester was doing work equivalent to plowing a 12-inch furrow 4.6 in. deep and the other team a 12-inch furrow 6.6 in. deep."

"Each machine did its gathering and cutting very nicely, but the McCormick packed and tied its bundles much tighter than did the Deering, and in studying the results it must be kept in mind that on this account and because double the amount of corn per acre was cut by the McCormick the draft trials are in no sense comparable; neither were they intended to be; our object was simply to learn what work 2 horses were called upon to do with these machines as they were being worked."

Comfortable low-cost barns, F. E. EMERY (*North Carolina Sta. Bul. 142, pp. 139–154, figs. 9*).—Plans and specifications are given for 2 cheap small barns, a barn constructed by the State Geological Survey, a circular barn and yards for 30 cows, and the North Carolina Station farm barn. In addition some conveniences in feeding boxes and safe fastenings for doors are figured and described, and home-made cattle fastenings are illustrated and described.

The uses of wood, F. ROTH (*U. S. Dept. Agr. Yearbook 1896, pp. 391–420, figs. 7*).—Comparisons are made of the relative importance of wood and metals, of the differences in structure and composition of various kinds of wood in relation to strength, toughness, stiffness, weight, color, durability, fuel value, texture, etc. The uses of wood and the utilizing of timber are considered.

Irrigation on the Great Plains, F. H. NEWELL (*U. S. Dept. Agr. Yearbook 1896, pp. 167-196, pls. 2, figs. 9*).—The character and condition of the Great Plains and the need of irrigation in this region are briefly explained and the following topics are discussed in detail: Sources of water (streams, storm waters, and wells); methods of obtaining water (pumps, windmills, and steam and other engines); storing and conducting water (ponds, tanks, ditches, and flumes); applying water; duty of water; and cultivation.

The sewage fields and the public milk supply of Paris (*Rev. Sci. [Paris], 4. ser., 8 (1897), No. 14, pp. 430–433*).

Experiments on water lifts, A. CHATTERTON (*Agr. Ledger [India], 1897, No. 17, pp. 16*).—This is a report on comparative trials of 3 forms of water lifts in use in India for raising irrigation water.

An instrument to aid in studying the wear of teams, W. W. CARSON (*Univ. Sci. Mag. [Knoxville], 1897, No. 3, pp. 5–21, pl. 1, figs. 5*).—A description is given of a cheap instrument designed for a 2-horse team, which measures and records with tolerable accuracy (1) the distance traveled by the team, (2) the pull on each singletree at every point of that distance, (3) the grade, (4) the speed, and (5) the total work done on each singletree. Details of construction are given and numerous tests of accuracy are reported.

STATISTICS—MISCELLANEOUS.

Agricultural education and research in Belgium, A. C. TRUE (*U. S. Dept. Agr. Yearbook 1896, pp. 361–370*).—This article describes the European *vs.* the American method of promoting education; general characteristics of Belgian agriculture; the organization of agricultural education in Belgium—the higher institutions for education and research, the secondary schools, lecture courses for adult farmers, and primary education; agricultural societies; experiment station at Gembloux, and gives a comparative view of agricultural education in the United States.

"[The Belgian system] provides for primary, secondary, and superior schools or courses of agriculture. Primary agricultural courses for adult farmers are conducted under the direction of the ministry of agriculture, while courses of a similar grade for teachers and children are supervised by the ministry of public instruction. The secondary and superior schools of agriculture, as well as other agencies for promoting agricultural education and research, are directed by the ministry of agriculture."

After describing the work of these different grades of institutions the author says, in conclusion:

"In view of the strenuous efforts which European countries are making to give regular instruction in agriculture to large numbers of their rural population, it is well that our farmers should seriously consider their needs in this direction and the best ways in which these needs may be supplied. It is certain that the colleges of agriculture need to be strengthened and developed in order that the leaders in agricultural education, research, and progress in this country may be as thoroughly trained as they are in the Old World. The grade of instruction in these colleges needs to be raised rather than lowered, and it is not to be expected that these institutions will send back to the farms any considerable body of practical farmers. Their graduates will for the most part be needed as teachers, investigators, editors, officials, and managers of those agricultural industries in which scientific attainments are indispensable to success. If any considerable number of the farmers of the coming generations are to have definite instruction in agriculture, it must be in schools and courses specially devised to meet the needs of those who for any reason are unable to take the long and expensive college course. This article will have served its purpose if it contributes in any measure to an intelligent examination of the problems involved in providing a suitable system of agricultural education in this country."

Reports of board of control and treasurer of Connecticut State Station, 1896 (*Connecticut State Sta. Rpt. 1896, pp. XVI, 399–414*).—This contains announcements relative to the publications of the station and to gratuitous chemical and botanical work of the station; a brief review of the work of the year by the secretary of the board of control; a financial report for the fiscal year ending September 30, 1896, and a comprehensive index.

Tenth Annual Report of Illinois Station, 1897 (*Illinois Sta. Rpt. 1897, pp. 18*).—Lists of the bulletins published by the station and of experiments in hand during the year, and a detailed financial statement for the fiscal year ending June 30, 1897.

Reports of director and treasurer of Wisconsin Station, 1896 (*Wisconsin Sta. Rpt. 1896, pp. 1–9, 323–331, fig. 1*).—A review of the year's work; lists of exchanges, acknowledgments, and of available publications of the station, and a financial statement for the fiscal year ending June 30, 1896.

Seventh Annual Report of Wyoming Station, 1897 (*Wyoming Sta. Rpt. 1897, pp. 22, Append. pp. 84*).—Brief abstracts of the bulletins published during the year, plan of work at the station and substations, treasurer's report for the fiscal year ending June 30, 1897, and an appendix containing reprints of Press Bulletin 5 on Cooperative sugar-beet tests and of Bulletins 32 and 33 of the station.

Yearbook of the Department of Agriculture, 1896 (*U. S. Dept. Agr. Yearbook 1896, pp. 686, pls. 4, figs. 163, dgms. 9*).—This includes a general report by the Secretary on the operations of the Department during the year; numerous semipopular articles noted elsewhere, and an appendix containing notes on the organization of the Department, the agricultural colleges and experiment stations, agricultural statistics, composition of feeding stuffs and farm products, feeding standards, analyses of fertilizers, amount and value of barnyard manure produced by different farm animals, methods of controlling injurious insects, preparation and use of insecticides and fungicides, a cheap orchard spraying outfit, seed standards, hawks and owls, timber, lumber, and wood, irrigation, number, weight, and cost of grass seeds and the amount to sow per acre, metric system, Department publications, and a comprehensive index.

Crop report for November, 1897 (*U. S. Dept. Agr., Division of Statistics Rpt. 154, n. ser., pp. 4*).—This gives preliminary estimates of the average yields per acre and average quality of certain crops in the United States, and a review of the forage crop situation with especial reference to wheat.

Austria-Hungary as a factor in the world's grain trade; recent use of American wheat in that country, F. H. HITCHCOCK (*U. S. Dept. Agr., Section of Foreign Markets Circ. 19, pp. 23*).—This includes a report by United States Consul G. R. Ernst relative to the present wheat shortage in Austria-Hungary and the importation into that country of American grain, and statistics on the production and importation and exportation of wheat and other grains for the years 1886 to 1895, inclusive. The statistics show that "not only in the case of wheat, but also in that of the various other cereals, the tendency has been toward a larger home consumption of the national product and a consequent reduction of the surplus available for shipment to other lands. To such an extent have the exports declined and the imports increased that most of the cereals are now brought into the country in larger quantities than they are exported. Barley is the only grain of which any considerable amount continues to be shipped abroad."

Exports of animals and their products, D. E. SALMON (*U. S. Dept. Agr., Bureau of Animal Industry Circ. 17, pp. 3*).—This gives statistics relative to the exports of animals and animal products from the United States to all other countries and to the United Kingdom for the fiscal years 1889-'96.

Synoptical index of the reports of the statistician, 1863 to 1895, G. F. THOMPSON and G. W. HILL (*U. S. Dept. Agr., Division of Publications Bul. 2, pp. 258*).

An ideal department of agriculture and industries, E. TISSERAND (*U. S. Dept. Agr. Yearbook 1896, pp. 543-554*).—This is reprinted from the Report of the Recess Committee (House of Commons) on the Establishment of a Department of Agriculture and Industries for Ireland, London, 1897.

The author discusses the necessity for a department of agriculture, fundamental principles of a department of agriculture, methods of control in France, encouragement of private agricultural schools, cooperative agricultural experiments, securing scientific assistants, the scope of a department of agriculture, functions of an Irish department of agriculture, divisions of ministry of agriculture, qualifications of a minister and of heads of diverse consultative bodies, and permanent technical committees.

Experiment stations, fields, and laboratories of the southwestern section of Russia and a plan of unification of their work, YANOUSHEVSKI (*Zemledyelie, 1896, No. 13*).

Agriculture in the Transcaspian region, A. RODZEVITCH (*Selsk. Khoz. i Lyesov., 1896, No. 1*).

Agriculture in Buenos Ayres (*Mitt. Deut. Landw. Gesell., 12 (1897), No. 20, Suppl. pp. 113-120*).—The climate, soil, vegetation, and commerce of the province are discussed. Crop statistics are given.

Agricultural calendar for Finland (*Landtbruks-kalender för Finland. Prepared by Landtbruks styrelsen, Helsingfors, 1897, pp. 114*).—Gives a complete directory of the officers of agricultural educational and investigational institutions and agricultural and horticultural societies; regulations for the periodical Finnish butter exhibitions, and the various societies and associations for the advancement of Finnish agriculture.—F. W. WOLL.

NOTES.

Iowa College and Station.—James W. Wilson has resigned his position as assistant in animal husbandry in the college and station to become private secretary to the Secretary of Agriculture; and John A. Craig, formerly of the Wisconsin Station, has been elected to fill the vacancy.

Missouri College and Station.—This college and station sustained a severe loss in the destruction by fire on November 8, 1897, of the residence occupied by H. J. Waters, dean of the college and director of the station. All the experimental records were saved. The insurance of $5,000 practically covers the loss.

New York Cornell Station.—G. N. Lauman has been appointed assistant horticulturist of the station.

Vermont College and Station.—Hon. Crosby Miller, for 20 years trustee of the State Agricultural College and for 11 years member of the board of control of the station, died at Pomfret, Vermont, on November 22, 1897.

American Forestry Association.—The first copy of the new organ of the Association, The Forester, formerly published by John Gifford, has been received. The Association has terminated its arrangement with the Pennsylvania Forestry Association by which the monthly publication of the latter, Forest Leaves, was recognized as the organ of the Association. The new journal "will contain not only popular articles and news of the forestry movement, and the like, but also technical articles of use to owners of woodlands, parks, grounds, and consumers of wood material." The number contains in addition to editorial and news items an account of the sixteenth annual meeting of the Association, held at Washington, D. C., December 8, 1897. This includes the address of the president of the Association; the report of the executive committee on Federal legislation, administrative action, forestry in Pennsylvania, tariff legislation, association meetings, publications, increase of membership, etc.; and the resolutions adopted. The officers for the ensuing year are: Francis H. Appleton, Boston, Mass., president; Sir H. G. Joly de Lotbiniere, Quebec, Canada, first vice-president; George C. McLanahan, vice-president for the District of Columbia; Frederick H. Newell, Washington, D. C., corresponding secretary; George P. Whittlesey, Washington, D. C., recording secretary and treasurer; and B. E. Fernow, F. V. Coville, Edward A. Bowers, D. M. Riordan, Gifford Pinchot, and Charles C. Binney, executive committee.

A Standing Commission for Agricultural Experimentation in Hungary.—The Hungarian Minister of Agriculture has created a permanent commission for agricultural experimentation, in which the different branches of agriculture are represented by practical men. This commission will outline a plan for the general work in the interest of agriculture, exercise a control over the same, and pass upon the subjects for special investigation.

Personal Mention.—J. B. Carruthers has been commissioned by the Planters' Association to study plant diseases in Ceylon.

J. G. Luehman, assistant to the late Baron von Mueller, has been appointed his successor and is now in charge of the National Herbarium at Melbourne, Australia.

Prof. A. Stutzer, director of the agricultural experiment station at Bonn, has been elected professor of agricultural chemistry and agricultural bacteriology at the University of Breslau. He will be accompanied by his present assistant, Dr. Hartleb.

Dr. Karl Müller, director of the agricultural experiment station at Hildesheim, died October 24, 1897, at the age of 50 years.

EXPERIMENT STATION RECORD.

Vol. IX. No. 7.

In the preparation of its annual report on the work and expenditures of the agricultural experiment stations this Office has recently made a review of the station publications received during the fiscal year ending June 30, 1897. Excluding annual reports which are wholly administrative documents containing neither accounts of station work nor practical information based thereon, 335 publications from the stations in the United States came to this Office during the past fiscal year. Of these, 98 were compiled bulletins of information and 47 recorded meteorological observations or fertilizer analyses. If we add the bulletins in which small experiments are made a sort of peg on which to hang a large amount of compiled data, it may safely be said that only about one-half of our station publications contain accounts of investigations regularly conducted by the stations with a view to extending the boundaries of our knowledge regarding the science and practice of agriculture. These statistics deserve serious attention chiefly from the fact that it is believed they represent a tendency in the experiment station enterprise in this country which unchecked will lead to very bad results. The rapid expansion of the experiment stations soon after the passage of the Hatch Act ten years ago made it almost necessary that a large amount of compiled information should be published in many States in order to lay the foundation for the intelligent understanding of the original work of the stations as soon as this had reached a state sufficiently advanced to warrant its publication for general distribution to farmers. It was supposed that by the time the new stations were really ready to publish their own work the necessity for compilations would have very largely passed away. But on the contrary the success of the stations has stimulated the demand for practical information, and the stations have increasingly yielded to the temptations to enlarge their popularity by sending out numerous bulletins of information even though these might be prepared at the expense of original investigations. So strong has been the influence in this direction that of late it has been seriously argued by some leading station workers that after all it should be the chief business of the stations to give the farmers such information as they need to aid them in improving their practice or defending themselves against ills common to their art.

A more subtle and, as we think, a more pernicious result of this tendency has been its effect on the investigations attempted by the stations. Many superficial experiments have been undertaken by the stations in response to the demand of farmers for results of immediate practical application. It is easy thus to give the impression that a large amount of work is being done at the station when really most of it may be of comparatively little value. Oftentimes experiments are tried in one line for a year or two and then something else is substituted as the popular demand shifts from time to time. As long as station workers dwell chiefly on the immediate practical needs of the farmers and listen only to their cries for help in this or that direction it is almost inevitable that their investigations will very largely follow so called practical lines and their methods of work keep dangerously close to those of the farmer. The strength of the movement for the practical education of the farmer, which during the past decade has been gathering head in the United States with wonderful rapidity, makes it all the more necessary that the experiment stations should carefully look into the future and should inquire with more diligence every year as to the proper limitations of their work. Clearly the trend of civilization is in the direction of specialized agencies for the performances of particular functions. It will be strange indeed if the agencies established for the express purpose of advancing the boundaries of knowledge regarding the science of agriculture as related to its practice can successfully follow any different path from that pursued by other similar institutions. How would the medical profession or even the general public regard the proposition that the specialists who, in their laboratories and hospitals are bearing almost the entire burden of establishing the principles and methods on which the practice of medicine is now making some real advance, should give up their researches for even half their time and devote themselves to writing popular treatises on the causes and remedies for prevalent diseases? They might thus perhaps save some valuable lives which will be lost because of ignorance of the present teachings of medical science, but who can not see that it is far better to keep these specialists at their work of investigation and try in other ways to widely disseminate the results of their researches.

It has sometimes been argued that the stations may profitably do a large amount of "demonstration" work, as distinguished from original investigation. If, however, such work once engages the attention of a station to any considerable extent, there is almost invariably a tendency to allow it to improperly encroach on the time and energy of station workers. It is so much easier to make a fair show in field, stable, or laboratory by doing over again what somebody else has taught us how to do well than to study, and plan, and toil to gain new truth. Demonstration of old truths belongs to the college and other educational agencies. It should never be more than an incident in the work of an experiment station. When our people are ready to supply the funds to maintain "demonstration fields," as is done in France in numerous localities, they may easily become valuable adjuncts to the agricultural colleges and experiment stations. But when an experiment station descends from its high estate as an institution of original research to win favor by illustrating, on however large a scale, well-known facts and principles it sells its birthright for a very small consideration. It should ever be the chief business of the stations to give to American agriculture the new ideas which will give preeminence in the world's competition. Neither station officers nor farmers should be content to have the stations largely engrossed in doing anything less important than this.

The idea that the station workers may wisely pattern after successful farmers in organizing and conducting investigations is an especially mischievous one. It may be, as some have asserted, that in many important lines of farm work agricultural science is not at present able to suggest any way to improve the best present practice. But unless we believe that science has no hope of aiding the farmer, however thorough or far-reaching its researches may be, let us not disparage any honest effort to make scientific investigations in behalf of agriculture as thorough and rigid as is possible. As long as there is any expectation that further efforts properly directed may enable science to solve the hitherto inscrutable problems of agriculture let us devote ourselves heart and soul to the organization and prosecution of the most thorough investigations. If in any case the scientific structure thus far erected consist of facts of doubtful value or principles of uncertain origin, let us tear the whole thing down and begin over again with a greater devotion to truth. Fortunately the most severe criticism of agricultural science will reveal many facts and principles which can not be overthrown and which the best farmers would never have discovered by the ordinary methods of the farm. We need only to call to mind the wonderful advances in dairying under the stimulus of chemical and bacteriological investigations or the hopeful aspect of the researches on the utilization of the nitrogen of the air to show that all the signs of the times point to the highest practical achievements as the outcome of scientific work in behalf of agriculture if we will only devote ourselves earnestly and wisely to such efforts.

It may be that we need, on the other hand, to regard more scrupulously the necessary limits of scientific effort in behalf of agriculture. Certainly the comparatively meager results which have come from a vast number of field experiments of certain classes with crops and fertilizers should lead to the most careful consideration of the methods of such work. The continued large use of funds in this direction can hardly be justified unless it is possible to improve the methods of our investigations so as to give us greater confidence in the results. If it is clear to the experienced and scientific investigator of agricultural problems that the methods in common use in any line are based on false principles or that it is impossible to reach any definite conclusions by the best planned investigations in that line, it is his duty to advise the experiment stations to withdraw from that branch of work. It is not right to lead the farmer to believe that science may aid him in any given direction when scientific men are themselves convinced that such a thing is impracticable. We need to have clearer distinctions drawn between science and pseudoscience as related to agriculture. But within the field in which it is agreed that science may reasonably work to aid the farmer—and this is a large and rapidly expanding area—let there be strict devotion to the truths and principles which science teaches and let us be done with the nonsense about imitating the practical man—who during countless past generations has not succeeded in advancing knowledge even with the rapidity of the traditional snail's pace. By adherence to his faith in the mission of science to agriculture the experiment station worker will most surely win the respect of the farmer and advance the highest interests of agricultural practice.

We believe that the time has come for the friends of the experiment stations in this country to declare themselves boldly in regard to the proper limitations of their work. The stations have a great fund intended for original research in behalf of agriculture. There is more need than ever before of scientific effort for the benefit of our agriculture and more promise than ever before of successful results from scientific investigations. The popularity of the stations has led to the practical diversion of much of their funds in the direction of pseudoscientific effort and the dissemination of general information. It is time to call a halt. Make the stations what they were intended to be, institutions for original research. Man them with the best experts and hold these men to their legitimate work. Keep the fountains of new truth pure and bubbling, enlarge their capacity, guard them against defilement. In this way alone will the future of our agriculture be made secure.

AGRICULTURAL EDUCATION AND RESEARCH IN THE SCANDINAVIAN COUNTRIES AND FINLAND.

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More than two-thirds of the territory occupied by the Scandinavian countries and Finland lies north of the sixtieth parallel, the latitude of Cape Farewell, the southern extremity of Greenland, and of Cape Chidley, the northernmost point of East Labrador. Thanks to the beneficent influence of the Gulf Stream on the climate of the European countries mentioned, conditions of life and industries are there of a wholly different character than what are found in the parts of America lying near or within the Arctic Circle. As a result, the Scandinavians rank among the foremost of civilized nations as regards both intellectual and material achievements. They have been able to vigorously attack the problems presenting themselves for solution and have offered valuable contributions to the progress of mankind. These countries early saw the benefits to be derived from technical instruction and investigation in agriculture and allied branches. Their system of agricultural education is highly developed and, in some of its phases, is not surpassed in other countries. A general inquiry into the methods of agricultural instruction in Scandinavia, and into the results of the research work done there in the line of agriculture, can not therefore fail to be of interest and may prove valuable to the student of agriculture.

In the summer of 1896 the writer visited a number of the Scandinavian and Finnish agricultural institutions of education and investigation, as a representative of the United States Department of Agriculture, and had good opportunities of becoming acquainted with these institutions, their working methods, and the men in charge. All the higher agricultural colleges of the countries mentioned were visited, and 6 agricultural elementary schools, 8 chemical control experiment stations, and 6 seed control stations. In other cases much information was gained by correspondence.

In this report the effort will be to give a comprehensive account of the system of agricultural instruction and investigation in the Scandinavian countries and Finland, and to bring forward its characteristic features. In order to convey some definite idea of the general conditions of the countries, their areas, population, the importance of agriculture in them, etc., it may be well, at the outset, to give a few statistical data in this line. The figures given below and elsewhere in this report are from official sources and are the latest available in all cases:

Area and population of Scandinavian countries.

Country.	Area.	Population.	Population per square mile.	Rural population.
	Sq. miles.			Per cent.
Norway	124,445	2,000,917 (1890)	16.1	82
Sweden	172,876	4,873,183 (1894)	28.2	80
Denmark	15,289	2,185,335 (1890)	142.9	66
Finland	144,255	2,431,953 (1892)	16.9	90

Sweden, the largest of the four countries, is about the size of the State of California, or about twice as large as the State of Minnesota; and Denmark, the smallest of the Scandinavian countries, is a little larger than Maryland, or about half the size of South Carolina. Keeping these relations in mind, the following table, showing the number of institutions of agricultural instruction and research in Scandinavia, will prove of interest:

Number of institutions for agricultural instruction and research.

	Norway.	Sweden.	Denmark.	Finland.
Educational institutions:				
Agricultural colleges	1	2	1	1
Agricultural intermediate schools				2
Agricultural elementary schools	18	38	17	14
Dairy schools	10	16	3	17
Horticultural schools	3		3	4
Forestry schools	2		1	2
Farriery schools		1		3
Total	34	57	25	43
Institutions for investigation or control:				
Chemical control stations	1	7	1	2
Milk control stations	3			
Seed control stations	3	19	1	2
Experiment stations	1	3	1	2
Total	8	29	3	6

The four countries have, on an average, an agricultural school for about every 58,000 of the rural population, and a control or experiment station for every 220,000 of the rural population. In order to reach a similar ratio in the United States there would have to be about 870 agricultural schools and 230 experiment stations; or, if the difference in the density of population (Scandinavian countries having 25.2 persons to the square mile and the United States 21.3) precludes comparison on this point, the State of Pennsylvania, with 117 persons to the square mile and 59.1 per cent rural population, should have 54 agricultural schools and 14 experiment stations.

The character of the land area of the four countries is indicated by the data presented in the following table:

Productive area, forest area, etc.

Country.	Productive area.	Forest area.	Under cultivation.
	Per cent.	*Per cent.*	*Per cent.*
Norway	28.9	24.0	*a* 2.8
Sweden	56.7	44.4	8.2
Denmark	90.7	4.7	44.5
Finland	65.4	57.4	3.0

a Pastures and meadows, 2.1 per cent.

The greater portion of the farm land is owned by small holders in all four countries, as will be readily observed from the following statement, which also includes other information illustrating the agricultural conditions of the Scandinavian countries:

Agricultural statistics.

Country.	Number of farms.	Farms under 20 hectares (50 acres).	Per 100 inhabitants.		
			Acreage of cereal crops.	Number of milch cows.	Agricultural capital, 1888.
Norway	146,355	93.8	25	35	$315
Sweden	329,593	86.0	80	34	310
Denmark	233,037	87.4	150	46	685
Finland	114,769	*a* 77.8	66	39	175

a Under 25 hectares.

AGRICULTURAL EDUCATIONAL INSTITUTIONS.

The system of agricultural education in the Scandinavian countries and Finland is arranged along two distinct lines, viz, elementary and higher instruction. The schools providing elementary instruction in agriculture are located in different parts of the country and are supported largely, though seldom wholly, by State aid, the districts in which the schools are located (*amt*, *län*, *stift*) paying the remaining portion of the expense. In Norway the State generally contributes three-fourths of the expenses to the support of the elementary schools, while in the neighboring countries a definite sum of money, ranging from 1,000 to 10,000 crowns (1 crown=26.8 cents) or more, is appropriated annually for their support. The institutions offering higher instruction in agricultural branches are supported wholly by the respective States.

The elementary schools provide both practical and theoretical instruction (the Swedish *landtmanna* schools excepted, to which reference will be made below), while the higher agricultural schools are essentially theoretical, previous experience in ordinary farm work being required of students.

In addition to these two kinds of schools, Finland has two intermediate schools, with courses of instruction corresponding to some extent to the German *Mittel-schule.* There are, however, a number of schools in the Scandinavian countries, classed as elementary, which give equally as advanced courses as these two Finnish middle schools.

The elementary agricultural schools of the different countries will be considered first.

ELEMENTARY AGRICULTURAL SCHOOLS.

Since the organization and the plan of instruction of these schools do not differ greatly in the four countries under consideration, the differences found being of minor importance, the more prominent features of the system as seen in operation in one country, *e. g.*, Norway, will be given, with briefer reference to the schools of the other countries, pointing out any characteristics worthy of special notice.

Elementary agricultural schools in Norway.—The instruction given in the elementary agricultural schools of Norway is built upon common school education, the aim being "to impart fundamental knowledge in agricultural branches to future farmers." To be admitted as a pupil the candidate must be 18 years of age, must produce a doctor's certificate that he is strong, without bodily defects, and free from contagious disease, and a certificate of character from his pastor. He must be able to write fairly correctly from dictation, be efficient in plain arithmetic, and have a fair knowledge of geography and the history of their country. At least one year's practice in ordinary farm work is required, and an application, written by the candidate himself, is to be sent to the director of the school. The candidates must finally pass an extrance examination in composition, arithmetic, geography, and history before being admitted as pupils. Preference is given to applicants living in the district where the school is located (which partly supports the school) and to eldest sons owning allodial rights, who therefore may be counted on settling as farmers in the district.

The number of students who can be accommodated in one of these elementary agricultural schools varies from 12 to nearly 100, the average number being about 27. The total registration of the schools during 1895–'96 was over 450. As the number of applicants always greatly exceeds the number that can be accommodated, only those well qualified for the work of the school and who intend to become farmers in the district in which the school is located, are as a rule likely to be admitted.

The schools are located in the country on farms belonging to the respective districts (counties) and operated at their expense. In a few cases the director or principal has no salary except the proceeds from the farm sales, and in such cases he is allowed to sell only animal products—no grain, hay, or straw. The farms vary in size from 100 to 200 acres or more. They are generally well equipped with buildings, farm machinery, library, instructional apparatus, improved stock, etc.

The director must be a practical farmer. He usually holds a diploma from the agricultural college at Aas, and often he has continued his studies abroad, along special lines, after graduation. It is required of him to conduct the farm so that it forms a good object lesson and a model, both for the pupils themselves and for the farmers of the surrounding district.

The number of teachers at the schools, in addition to the director, varies somewhat according to the development and conditions of agriculture in the various districts. There is generally a "second teacher," who is the assistant of the director, and teachers in horticulture, forestry, and dairying. The latter are experts in their particular lines, and teach only these branches, while the general fundamental branches are taught by the director and the "second teacher."

The course of instruction offered in these schools is partly theoretical, partly practical, and lasts one and a half or two years. The theoretical branches are taught during the winter months, viz, from October to April; the practical work then commences and runs through the summer until after the harvest. There is generally a vacation of three weeks or a month after haying and two weeks' vacation at Christmas. The theoretical instruction occupies three hours a day and covers the following preparatory studies: Composition, practical arithmetic, plain geometry, chemistry, and physics. The basal studies taught are agriculture (including mineralogy, geology, botany, and physiology), animal husbandry (including dairying), forestry, horticulture, bookkeeping, and farm accounts. Practical exercises are given in surveying, map drawing, farm machinery and farm buildings, drainage, forestry, horticulture, blacksmithing and carpentry, and geological and botanical excursions. Practical work in the field or barn occupies the full time of the students during the summer, when they take part in the regular farm work under the supervision of the director or the second teacher. The work in blacksmithing and carpentry comes throughout the year by rotation, one or two students at a time having exercises in these branches each day or afternoon. The class-room instruction consists largely of recitations from text books, and written compositions on the subjects treated are frequently required.

The students as a rule pay a small fee for tuition, room, and board, ranging from 100 to 300 crowns ($26.80 to $80.40) a year. This fee covers all expenses except for books and stationery. The different counties provide a number of full or half scholarships ("free seats") for poor, worthy scholars, or give stipends to such scholars amounting to the tuition fee or more. The number of "free seats" varies in the different schools. Often 3 or 4 in a class of 20 have free tuition, sometimes 10 or 12. As a general rule, a distinction is made between students from the district supporting the school in part and outsiders. The former pay only for board and lodging (about $26.80 a year), while others, special or private students, pay a tuition fee in addition. The students do not receive any pecuniary compensation for their work on the farm during the summer or at other times.

At the completion of the full course, the students are subjected to written and verbal examinations—the former in agriculture, animal husbandry, and practical arithmetic; the latter in agriculture and botany, animal husbandry, forestry and horticulture, chemistry and physics, practical arithmetic and geometry. The pupil is marked in each study, and on passing the examination and properly completing the course receives a diploma from the school, giving in detail his standing in each study and his average standing, together with remarks on his industry and behavior during his school life. The diploma is signed by all the teachers and the "censors" (special examiners appointed by the board of regents of the school to conduct the examinations in conjunction with the teachers).

The following list of elementary agricultural schools in Norway is complete up to date (January, 1897). As previously stated, the schools are supported partly by the State and partly by the local district (*amt*). The school at Bodö in the northern part of Norway forms an exception to this rule, being supported by the State alone, the salary of the teachers and all expenses of 20 pupils, 10 from Nordland and 5 each from Finmarken and Tromsö *amt*, being provided for by State appropriation. Other pupils of this school have free tuition and rooms, lighted and heated, but pay 26 crowns ($7.03) per month for board.

Elementary agricultural schools of Norway.

Location.	District.	Year established.	Number of students, 1895–'96.	Government appropriation, 1895–'96.
Sem	Akershus	1888	16	$1,206
Aas	do	1871	30	
Kalnes	Smaalenene	1870	24	2,884
Jönsberg	Hedemarken	1847	46	2,738
Storhaave	Kristians	1857	36	2,144
Fosnäs	Jarlsberg and Laurvik	1895	20	2,412
Söve	Bratsberg	1893	24	3,282
Sögne	Lister and Mandal	1895	12	2,090
Langtveit	Nedenäs	1896		
Björnetrö	do	1896		
	do	1896		
Tvet	Stavanger	1877	32	1,769
Stend	S. Bergenshus	1866	24	2,556
Mo	N. Bergenshus	1858	12	1,099
Vestnäs	Romsdal	1887	20	1,983
Trondhjem	S. Trondhjem	1895	15	1,407
Märe	N. Trondhjem	1895	22	375
Bodö	Tromsö	1892	20	3,897
Christiania *a*	Christiania	1886	86	1,340

a Private theoretical school.

Elementary agricultural schools in Sweden.—The lower agricultural schools of Sweden are of two kinds, so-called *landtbruksskolor* (agricultural schools) and *landtmannaskolor* (farmer schools). The former resemble the elementary agricultural schools of Norway in giving both practical and theoretical instruction, while the latter are purely theoretical and correspond in some measure to our American short courses in agriculture.

The objects of the *landtbruksskolor* are "to give practical experience in the performance, planning, and supervision of farm work, and to offer instruction in the fundamental principles underlying farm practice." They are therefore primarily practical schools. The courses last two years, beginning on the first day of November and continuing throughout the year. The practical instruction consists in participation in all kinds of farm work in the field, stable, barn, and blacksmith and carpenter shops. In this work the second-year students act as foremen, keeping journals of the work done under their direction and also taking part in the work themselves, as is the usual practice with foremen on Swedish farms. The theoretical instruction covers the following subjects: Composition, arithmetic, drawing, geometry, natural history, agriculture, animal husbandry, dairying, forestry, horticulture, and farm bookkeeping. This instruction is given during the winter months, four to five hours daily. The average number of hours of theoretical instruction during the year was in 1895, for first-year students, 347 hours; for second-year students, 679 hours, the number ranging at the different schools between 207 and 466 hours for the first-year students, and between 486 and 868 hours for second-year students.

Students must be at least 18 years of age on entering the schools, and must have similar qualifications to those required by the elementary schools of Norway. The average age of students entering these schools is, however, considerably higher than the limit set, being between 22 and 23 years. On passing the final examinations and otherwise successfully completing the course the students receive diplomas from the school.

The Swedish *landtbruksskolor* were established in 1840. They are supported in part by a Government appropriation of 4,000 crowns ($1,072) each, or where more than one school is held inside of a county (*län*), 2,000 crowns to each of the others, on condition that the agricultural society or county board appropriate a similar amount. There are at present 24 schools of this kind, 20 of which receive 4,000 crowns each and the remainder 2,000 crowns annually.

The second class of elementary agricultural schools, *landtmannaskolor* (farmer schools) are calculated to furnish young men with the theoretical agricultural education required for the proper management of smaller farms. The courses last 20 to 24 weeks, beginning on the last week day of October each year. The requirements for admission are somewhat higher than those of the practical schools, and in addition at least one year's experience in ordinary farm work is required. The studies taught in these schools are physics and meteorology, chemistry, botany, zoology, geology, agriculture, veterinary science, animal husbandry, dairying, architecture, geometry and surveying, farm bookkeeping, and drawing. On passing the final examinations the pupils receive a diploma signed by the principal of the school. The total number of hours of instruction during the course varied in 1895 from

595 to 1,001 at the different schools, or an average of 4 to 7 hours a day. The average total number of hours of instruction was 825, equivalent to 6 hours daily instruction.

The *landtmanna* schools were established in 1887. They receive 3,000 crowns ($804) annually from the Government on condition that a similar amount be granted by the county in which the school is located, that the plan of instruction be approved by the Government, and that one pupil for each thousand crowns granted by the Government be given a full scholarship, including tuition, board, and room rent. There are at present 14 of these agricultural schools in operation in Sweden.

The following statement shows the location of the Swedish elementary agricultural schools in operation during 1894–'95, with the number of students attending each school. The total enrollment of students was 527, and the average attendance was 14.4 for the *landtbruks* schools and 13 for the *landtmanna* schools.

Elementary agricultural schools of Sweden, 1895.

Landtbruks schools.			*Landtbruks* schools.		
Location.	District (*län*).	Number of pupils.	Location.	District (*län*).	Number of pupils.
Husby	Stockholm	14	Önnarp	Elfsborg	13
Nygård	Södermanland	16	Klagstorp	Skaraborg	15
Bjerka-Säby	Östergötland	24	Såtenäs	do	17
Johannisberg	Jönköping	19	Varpnäs	Vermland	14
Orraryd	Kronoberg	11	Lund	Örebro	13
Applerum	Kalmar	21	Tomta	Vestmanland	15
Troserum	do	12	Vassbo	Kopparberg	16
Borgholm	do	12	Runmo	Gefleborg	12
Elleholm	Blekinge	14	Nordvik	Vesternorrland	12
Oregårdn	Malmöhus	19	Yttertafle	Vesterbotten	12
Klef	Halland	6	Åminne	Norrbotten	7
Stora Vrem	Göteborg and Bohus	15			
Kilanda	Elfsborg	16	Total		345
Landtmanna schools.			*Landtmanna* schools.		
Upsala	Upsala	7	Hvilan	Malmöhus	20
Asa	Södermanland	14	Katrineberg	Halland	7
Lunnevad	Östergötland	8	Skara	Skaraborg	26
Södra Vi	Kalmar	13	Molkom	Vermland	7
Ebbetorp	do	12	Käfvesta	Örebro	11
Hemse	Gotland	10	Ope	Jemtland	14
Ronneby	Blekinge	13			
Önnestad	Kristianstad	20	Total		182

Elementary agricultural schools in Denmark.—The number of elementary agricultural schools in Denmark at the present time is 17. They are supported in part by small grants from the State and by the various agricultural societies, and are all private schools deriving their main income from tuition fees. At the larger and older of these institutions scholarships are provided, as a rule through private munificence, enabling poor and worthy pupils to frequent the schools as well as those in better circumstances.

The history of the oldest elementary agricultural school in Denmark, the Classen Agricultural School at Näsgaard, Falster, is remarkable from the fact that it was ready to receive pupils nearly 50 years before the constituency for whose benefit the school was established availed themselves of its facilities. The school was founded through the generosity of a Danish major-general, J. F. Classen (who died in 1792). His will contained a clause providing for the establishment of a seminary or agricultural institute for the benefit of "good subjects" of the farming class, where fundamental agricultural principles were to be taught during a course of from 3 to 4 years. The scholars were to have free rooms and board, and also the necessary cloth (*wadmol*) and muslin for wearing apparel. They were to be elected from the different parts of the country, on recommendation of the county magistrates. The agricultural society was asked to select a person who should fit himself for the professorship in agriculture at this school through 3 years' of travel in foreign countries. In 1793, a surveyor, Mr. Olufsen, was elected to the position; and he traveled through most of the European countries during the following years. On his return to Denmark he at once proceeded, in conjunction with the board of regents of the school and the State agricultural society, to carefully plan, build, and equip the school at Näsgaard, on the island of Falster, located in a beautiful region peculiarly well adapted for the purpose in view. The school was ready for occupancy in the summer of 1800, being the first of its kind in Denmark, and, as far as is known, in the world. (The agricultural school at Hofwyl, Switzerland, was founded in 1806.) Only one pupil presented himself, however, and the school could not be opened. "The farmers did not believe that anything could be gained by going to a school to learn how to run a farm." Two years later, no farmers' sons having applied for admission, the school was opened to other than farmers' sons. The equipment of the school was greatly strengthened by the addition of a farm of about 40 acres; and experimental plats, a botanical garden, fish ponds, orchards, etc., were planned and laid out. But in spite of all efforts no pupils could be induced to take advantage of the opportunities offered, and Professor Olufsen went to Copenhagen, where he met with considerable success as a lecturer on agricultural economics at the Classen Library. The school building, with the farm, was rented for a number of years, and later was operated as an experimental farm for studying problems in breeding horses, cattle, sheep, and swine.

With the development of the natural sciences and the gradual awakening of the European farming classes in the second quarter of this century, the time finally came when the school could be opened, pupils presenting themselves in 1849 through the efforts of leading patriotic Danish gentlemen. Since this time it has been in operation and has been regularly frequented by the limited number of students which can be accommodated. The course of study laid out covers two years, 9 students being admitted each year, or 18 in all. The total number of students that have gone through the school up to date is 431.

The instruction during the first year covers composition, arithmetic, mathematics, biology and botany, chemistry, physics, and dairying; and during the second year, animal husbandry (anatomy, breeding, and feeding), agriculture, agricultural physics, economic botany, farm machinery, dairying, veterinary science, farm bookkeeping, written exercises, drawing, and surveying. There are 3 regular teachers and 1 extra teacher connected with the school. The theoretical instruction occupies 3 hours daily, with practical exercises in field work in the afternoon.

There are several other elementary agricultural schools in Denmark, as shown by the following table, which contains information concerning their establishment, courses, total and average number of students, etc.:

Main elementary agricultural schools of Denmark (1895).

Name.	Location.	District (*amt*).	Year established.	Length of courses.	Total number of students.	Average number of students per year.
Classen	Näsgaard.	Lolland and Falster	1849	2 years' course with 9 months each year.	431	18
Odense	Odense	Fyn	1855	9 months	1,030	26
Lyngby	Lyngby	Seeland	1867	6 and 10 months	2,434	107
Tune	Taastrup	do	1871	6 and 9 months	3,037	74
Ladelund	Brörup	Jutland	1879	5 months	1,663	103
Dalum	Odense	Fyn	1886	6 months	*a* 849 *b* 265	106 36
Malling	Malling	Jutland	1889	6, 9, and 12 months		

a Agricultural. *b* Dairying.

Other agricultural schools are in operation at Lumby (established in 1858), Emdrupborg (1874), Faurbogaard (1875), Vinding (1878), Greisdalen (1879), Morsö (1884), Klank (1885), Yding (1889), Graneli, Aarup, and Oddense.

The number of young farmers who have received instruction in these schools up to the present time doubtless considerably exceeds 10,000. This is a remarkable showing, considering that the total population is only a little more than two million people (farming population, one and one-third million), and that it is less than 50 years since the first school began its work. The elementary agricultural schools of Denmark have of late years been frequented by more than 500 students annually, nearly all of whom are sons of Danish farmers and have chosen farming as their occupation.

Elementary agricultural schools in Finland.—As stated in the introduction, Finland has two intermediate agricultural schools, Kronoborg Agricultural Institute and Harjus Agricultural School. The former was established in 1874. Two different courses in agriculture are offered, one lasting 2 years and the other 1 year. A dairy course is also given. The Government grants scholarships to 20 pupils. Other students pay 20 marks ($4) a month for lodging and board. During 1893–'94 the institute was attended by 43 students in the 2 years' course, 11 in the 1 year course, and 14 in the dairy course, a total of 68 students. The instruction offered is both theoretical and practical. In 1893–'94 the following number of hours were given up to the various studies in the 2 years' course: First year—natural history, 122; arithmetic, 153; composition, 259; total, 534; second year—natural history, 30; arithmetic, 86; composition, 57; agriculture, 134; animal husbandry, 50; veterinary science, 65; farriery, 9; drawing, 40; forestry, 30; surveying, 65; agricultural law, 18; farm bookkeeping, 76; total, 660.

In addition the students took part in all practical work on the farm, in the field, barn, and stable, composting manure, threshing, tile-draining, grubbing, gardening, harvesting ice, road repairing, forestry work, etc., equivalent to 13,560 hours work for one man.

The faculty is composed of a director, a veterinarian, and a "third teacher," besides registrar, bookkeeper, farm superintendent, dairywoman, mechanic, and gardener. The estate consists of about 5,000 acres, 1,200 of which are under cultivation and 110 acres in pastures. The students are in general graduates of the Finnish common schools or high schools.

The second intermediate agricultural school in Finland, at Harjus, was opened for instruction in 1889. Like the preceding school it has 2 distinct departments, a semi-elementary course in agriculture lasting 2 years, and a theoretical winter course running through 2 seasons. Twenty scholarships are offered in the former course and additional pupils are accepted up to the capacity of the school, 36 being in attendance in 1893–'94. The winter course was frequented by 34 pupils during the same year. This course is limited to 40 pupils, all of whom have free instruction, rooms, and board. The plan of instruction given is more along theoretical lines and is more advanced than that followed at the elementary agricultural schools.

The daily program of these schools is interesting. At Kronoborg the recitations in the 2 year course are held from 6 to 8 o'clock in the morning and evening during the winter semester and during a few weeks in October. At Harjus the plan is as follows: 5 a. m., rising hour; 6 to 8, recitations; 8 to 9, breakfast; 9 to 2 p. m., practical farm or dairy work; 2 to 3, dinner; 3 to 6, study hours; 6 to 8, recitations; 8 to 9, supper; 10, bed time. The students working in the cow or horse stable, this work coming by rotation, rise at 4 a. m. In summer all the students rise at 4 a. m., begin work at 5 a. m., and finish work at 8 p. m., having 2 hours for meals and retiring at 10 p. m.

A third school with similar plan of instruction is held at Mustiala Agricultural Institute, being a distinct department thereof. This school will be referred to later.

These schools, as most other Finnish agricultural educational institutions, for a number of years past have been entirely unable to accommodate all the young men who have applied for admission. The number of applicants for 203 places in 1893–'94 was 572; in single instances the number applying for admission was five times the number that could be accommodated. To provide for this larger number of students, 6 elementary agricultural schools are now under organization, and provisions have been made for the establishment of 5 additional schools of this kind. When these latter have been established, there will thus be 22 elementary agricultural schools in operation in Finland. The following table gives statistics of those now in operation:

Statistics of intermediate and elementary agricultural schools of Finland, 1893–'94.

Location.	Number of students.	Year established.	State appropriation.	
			Regular.	1893–'94.
Mustiala, lower department *a*	34	1840	$13,912	$20,319
Kronoborg	51	1874	4,632	9,910
Harjus	70	1889	5,365	9,206
Söderkulla	25	1863	2,316	2,316
Tuorla	18	1885	1,853	1,853
Osara	17	1886	1,853	2,894
Otava	22	1859	1,853	2,229
Leväis	22	1860	2,316	2,316
Simananniemi	18	1886	1,853	2,603
Korsholm	15	1846	1,853	6,645
Tarvaala	17	1867	1,853	1,853
Orisberg	16	1885	1,853	2,123
Koivikko	18	1853	1,158	1,158
Haga	9	1888	1,853	1,853
Total	352	....	44,523	67,278

a The appropriation given is for Mustiala Agricultural and Dairy Institute.

Seven of the schools given in the preceding table are held on estates or large farms belonging to the Crown, the rest on farms belonging to private individuals. In either case the regular annual appropriation for each elementary school is 9,600 marks (about $1,800), except in special instances where the amount is increased to 12,000 marks ($2,300). The total appropriation for agricultural schools in Finland for the year 1893–'94 approached 350,000 marks, or about $70,000.

[Concluded in next number.]

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

Reasons for the variation in the citrate solubility of Thomas slag meal, P. WAGNER (*Landw. Vers. Stat., 49 (1897), No. 3, pp. 227–230*).—Bücking and Linck have found[1] in Thomas slags three distinct minerals, one with hexagonal crystals resembling apatite, another with bluish monoclinic crystals of the formula $4Ca_3P_2O_8+3Ca_3SiO_5$, and a third with yellowish rhombic crystals with the approximate formula $Ca_4P_2O_9$. These contain 36.8, 31.2, and 38.8 per cent of P_2O_5, respectively. The author has isolated these different minerals and determined the citrate solubility of each. He finds that 85.42 per cent of the P_2O_5 of the bluish crystals is soluble, 88.75 per cent of the yellow, and about 60 per cent of the apatite-like substance. He suggests that these differences in solubility may partially explain the variations noticed in the solubility of the phosphoric acid of different slags.—J. P. STREET.

Volumetric method for the determination of combined sulphuric acid, F. MARBOUTIN and M. MOLINIÉ (*Bul. Soc. Chim. Paris, 3. ser., 17 (1897), No. 22, pp. 950–955*).—This method, which is adapted to the analysis of water, is as follows: Acidulate 100 cc. of the water with hydrochloric acid and boil to drive off carbon dioxid. Add, drop by drop, 30 cc. of barium chlorid, maintaining the temperature of the solution meanwhile near the boiling point, and afterwards keep in an oven at about 40° until the precipitate has settled. Neutralize with a few drops of ammonia and add 30 cc. of potassium chromate. Heat slightly, and after cooling make the volume to 300 cc. To 100 cc. of the clear liquid add 2 cc. of sulphuric acid (1:4) and 5 cc. of arsenious acid solution, heat gently, and stir until color disappears. Neutralize with potassium carbonate and run in standard iodid solution until the blue coloration appears on testing with starch. The following equation is given, in which t=mg. of iodid in 1 cc. of the iodid solution; n=cc. of iodid solution required by each 100 cc. of distilled water; n'=cc. of iodid solution required by 100 cc. of the water tested, and x=mg. of sulphuric anhydrid in a liter of water:

$$x=10\,(n-n')\,3t\,\frac{3\times4\times127}{4\times80}.$$

If the iodid solution is exactly fiftieth normal (1 cc.=2.54 mg. of iodid) then

$$x=16\,(n-n').$$

[1] Ztschr. Stahl u. Eisen 1887, p. 245.

The reactions which occur are as follows:

$$K_2SO_4+BaCl_2=BaSO_4+2KCl,$$
$$BaCl_2+K_2CrO_4=BaCrO_4+2KCl,$$
$$4K_2CrO_4+2As_2O_3+7K_2SO_4=3As_2O_5+2\,Cr_2(SO_4)_3+4H_2SO_4+7H_2O,$$
$$4I+As_2O_3+2H_2O=As_2O_5+4HI.$$

The solutions used are as follows: Crystallized barium chlorid 4.8 gm. per liter, crystallized potassium chromate 3.9 gm. per liter, arsenious acid (dissolved in 10 gm. of potash, afterwards slightly acidulating with sulphuric acid) 4.95 gm. per liter.

The volumetric estimation of phosphoric acid (*New Jersey Stas. Rpt. 1896, pp. 118–121*).—The results of comparisons of the official method and of a modification of Kilgore's volumetric method[1] on 276 samples of complete fertilizers are reported. The volumetric method used is described as follows:

"Weigh 2 gm. of material into a porcelain crucible, evaporate with 3 cc. of magnesium nitrate, ignite and dissolve in hydrochloric acid. To an aliquot part of this solution (0.25 gm.) add 5 cc. of concentrated nitric acid, neutralize with ammonia, and clear with a few drops of nitric acid. Heat on the water bath to 60 to 65° C., add 50 cc. of freshly filtered molybdic solution for each decigram of phosphorus anhydrid present, and digest at the same temperature for 15 to 20 minutes.

"Decant the clear liquid on a filter as quickly as possible (a plain filter without suction). Wash the precipitate by decantation twice with the nitric acid solution, once with the potassium or ammonium nitrate solution, and transfer it to the filter and wash with 150 cc. of cold water. Wash the precipitate with the filter into the beaker, add an excess of the standard potassium hydroxid solution and a few drops of the phenolphthalein solution, and titrate the excess of alkali by adding the standard nitric acid solution until the color disappears. The number of cubic centimeters of alkali used, less the number of cubic centimeters of acid necessary to neutralize the solution, is equal to the number of milligrams of phosphorous anhydrid present."

The reagents used were in all cases the same as those recommended by Kilgore. The total percentage of phosphoric acid found by the official and the volumetric methods are tabulated.

"The results secured were extremely satisfactory, the average results by the volumetric method being 10.72 per cent against 10.70 per cent by the official method. Of these results, 150 were higher by the volumetric, 113 lower, and 13 identical with the official method; the greatest variation was 0.16 per cent, and 114 samples varied less than 0.05 per cent."

A new method of estimating fat in animal substances (preliminary notice), E. BOGDANOW (*Arch. Physiol. [Pflüger], 68 (1897), No. 8–9, pp. 431–433*).—It was found that when meat which had been extracted with ether was boiled with alcohol considerable material was dissolved, which on evaporating the alcohol was easily soluble in ether. By extraction with ether alone 6.65 per cent of the total dry matter of a sample of meat was removed. When a sample of the same meat was treated with ether until practically as much fat as possible had been removed and then boiled with alcohol, the alcohol evaporated and the residue extracted with ether, a total amount of fat equaling 11.486 per

[1] U. S. Dept. Agr., Division of Chemistry Bul. 46, p. 13; North Carolina Sta. Bul. 140 (E. S. R., 9, p. 416).

cent of the dry matter of the meat was obtained. The material extracted by the alcohol is not insoluble in ether, but in the author's opinion is intimately mixed with some matter not affected by the ether, but which the alcohol removes.

The direct determination of calcium carbonate, F. SESTINI (*Ann. Agron., 23 (1897), No. 7, pp. 326, 327*).—Digest 5 gm. fine soil in 100 cc. of 0.5 per cent acetic acid at the boiling point, in a flask with reflux condenser, until evolution of carbon dioxid is complete (about 1 hour). Cool, filter, and evaporate 55 cc. of the filtrate to 5 cc. Add hydrochloric acid (sp. gr. 1.1) and evaporate, repeating the operation until the acetic acid is all driven off and the acetates are converted into chlorids. Dissolve the residue from the evaporation in a small quantity of water, add 10 cc. of ammoniacal ammonium chlorid and make up to 55 cc., with 75 per cent alcohol. Filter to remove calcium sulphate, etc., and precipitate lime in 50 cc. of the filtrate with neutral ammonium carbonate, or, better, ammoniacal oxalate.

Application of hydrogen peroxid to the analysis of food stuffs, LEBBIN (*Pharm. Ztg., 17 (1897); abs. in Analyst, 22 (1897), Nov., p. 289*).—The author calls attention to the solvent power of hydrogen peroxid on starch, and reports some experiments on this. Attempts to estimate starch in this way do not appear to have given satisfactory results as yet. The reagent has been found useful in rendering material starch free for microscopical examination, as the appearance of the cellulose structure is unaltered. This has been found serviceable in distinguishing wheat flour from rye flour and also in detecting ergot in flour.

The author's method for the estimation of crude fiber by means of hydrogen peroxid has been described (E. S. R., 8, p. 857).

The determination of starch in the sweet potato, F. S. SHIVER (*South Carolina Sta. Bul. 30, pp. 11*).—Several well-known methods for determining starch are described and comparative studies with them reported. A volumetric method for the determination of the reduced copper with potassium permanganate was compared with the gravimetric method, with results "as concordant as could be expected, the difference in the average between the two being only 0.0005 gm. of copper." Comparisons were made on a number of varieties of the sweet potato of the Sachsse method (inversion with acid), the modified Reinke method (treatment with malt extract without pressure), the Maercker method (treatment with malt extract and heated under pressure with tartaric acid), and the Honig method (heating with glycerin). The results of the comparisons are summarized in the following table:

Comparative determination of starch in sweet potatoes.

Method.	Southern Queen.	Red Bermuda.	General Grant.	White Bermuda.	Georgia yams.	Yellow Jersey.	Bunch yams.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Sachsse	27.36	28.00	26.12	23.74	27.32	25.20	26.42
Reinke (modified)	25.29	26.86	23.93	21.31	25.77	22.73	....
Maercker (second)	25.14	26.66	....	....	25.88	....	....
Honig	24.45	25.98	....	22.34	25.23	....	....

"In view of all the work done on the determination of starch in the sweet potato, the Reinke method and Maercker's method are to be recommended, and of these the first is perhaps the best. . . .

"Asboth's method, which consists in precipitating the starch with a standard solution of barium hydrate, and then determining the excess of barium hydrate with standard acid, was tried, but the results were exceedingly unsatisfactory, so much so that I do not consider the results worth reporting."

On the chemical properties of diastase and the occurrence of araban in diastase preparations, A. WRÓBLEWSKI (*Ber. Deut. Chem. Gesell., 30 (1897), p. 2289; abs. in Chem. Ztg., 21 (1897), No. 93, Repert., p. 282*).

The estimation of carbonic acid in natural waters, C. A. SEYLER (*Analyst, 22 (1897), Dec., pp. 312–319*).

The exact estimation of total carbohydrates in acid hydrolized starch products, G. W. ROLFE and W. A. FAXON (*Jour. Amer. Chem. Soc., 19 (1897), No. 9, pp. 698–703, figs. 2*).—The authors give a formula for correcting the specific gravity when specific rotatory power is known, factors, etc., and various tests of the accuracy of these.

A contribution to the spontaneous combustion of vegetable food and feeding stuffs, F. HOFFMANN (*Wchnschr. Brau., 14 (1897), p. 437; abs. in Chem. Ztg., 21 (1897), No. 85, Repert., p. 233*).

Mechanical arrangement of fat-extraction apparatus, G. J VOLCKENING (*Jour. Amer. Chem. Soc., 19 (1897), No. 9, pp. 735–738, fig. 1*).—This shows the arrangement of sets of fat-extraction apparatus, generation of steam for heating the ether, etc.

On the determination of dry matter in peat, H. TRYLLER (*Landw. Vers. Stat., 49 (1897), No. 1–2, pp. 145–161, fig. 1*).—A discussion of the method, with the results of a large number of determinations.

On the speed of reduction of ferric alum by sugar, J. H. LONG (*Jour. Amer. Chem. Soc., 19 (1897), No. 9, pp. 683–698*).

On the determination of calcium, aluminum, and iron in phosphates, L. LINDET (*Ann. Chim. Analyt. et Appl., 2 (1897), No. 5, p. 291; abs. in Chem. Ztg., 21 (1897), No. 77, Repert., p. 211*).—The errors incident to the citrate method are pointed out and it is recommended to dissolve the phosphate in boiling nitric acid and precipitate in very dilute solution with ammonium molybdate. The method then proceeds as usual except that the precipitate of ammonium-magnesium phosphate and the filter are ignited separately to prevent reduction and loss of phosphoric acid.

The quick determination of phosphorus, H. WDOWISZEWSKI (*Stahl u. Eisen, 17 (1897), p. 814; abs. in Chem. Ztg., 21 (1897), No. 87, Repert., p. 248*).—A method applicable to iron and steel analysis. Dissolve 2 gm. in 30 cc. nitric acid (1.2 sp. gr.), dilute to 50 cc., and filter. Evaporate filtrate to original volume, oxidize with potassium permanganate, add hydrochloric acid to dissolve the manganese dioxid, cool, and neutralize with ammonia. Warm to 60° C., add molybdic solution, shake for 5 minutes, and let stand ¼ hour. Filter, wash the precipitate with 10 per cent ammonium nitrate solution, and dissolve in ammonia. Neutralize with hydrochloric acid, add magnesia mixture and excess of ammonia, allow to stand ¼ hour in ice or snow, shake 5 minutes, and filter.

Determination of phosphoric acid in natural phosphates, E. HÉNIN (*Ann. Chim. Analyt. et Appl., 2 (1897), p. 285; abs. in Chem. Ztg., 21 (1897), No. 77, Repert., p. 211*).—A form of Villier's method is used.

Estimation of alumina in phosphates, H. LASNE and VON GRUEBER (*Ztschr. Angew. Chem., 1897, pp. 276–278; abs. in Jour. Chem. Soc. [London], 72 (1897), No. 420, II, p. 518*).—Lasne claims priority for the use of sodium hydroxid in the separation of aluminum phosphate from iron and other phosphates. Von Grueber replies that he was not acquainted with Lasne's investigations when he published his method.

Estimation of sodium in the presence of potassium, F. F. BEILSTEIN and O. VON BLAESE (*Bul. Acad. Impér. Sci. St. Petersbourg, 33, p. 209; abs. in Ztschr. Analyt. Chem., 36 (1897), p. 513; Jour. Chem. Soc. [London], 72 (1897), No. 420, II, p. 518*).—"To the solution of the chlorids or nitrates, a solution of potassium antimonate is added. The supernatant liquid is decanted after 24 hours and the precipitate washed, first with a 0.7 per cent solution of potassium acetate, and then with 50 per cent alcohol. After ignition, it is weighed as $NaSbO_3$. For each 100 cc. of the decanted liquid (which must not contain potassium carbonate), 0.0233 gm. must be added to correct for solubility."

Determination of boric acid in meat products, C. FRESENIUS and G. POPP (*Ztsch. Öffentl. Chem., 3, p. 188; abs. in Analyst, 22 (1897), Nov., p. 282*).

On the titration of sulphuric acid solutions, F. MARBOUTIN and A. PÉCOUL (*Bul. Soc. Chim. Paris, 3. ser., 17 (1897), No. 18–19, pp. 880, 881*).

A new receiver for the steam distillation of oils, A. JUNGHAHN (*Chem. Ztg., 21 (1897), No. 68, p. 669, fig. 1*).—A covered beaker is tubulated on the side near the top for the reception of the short arm of a siphon, which reaches to the bottom of the receiver and which is open at the bend. As the products of distillation accumulate, the oil on top and the water at bottom, the level of the liquid reaches that of the bend in the tube, and any further addition of liquid causes an equal amount of water to flow out through the tube. When the distillation is completed, all the water may be siphoned out by closing the aperture in the siphon with the thumb and filling the tube with water by tilting the beaker. When all the water is out and the oil is about to escape, the thumb is removed and the siphoning ceases.—J. T. ANDERSON.

A self-regulating gas generator, W. W. ANDREWS (*Chem. Ztg., 21 (1897), No. 68, pp. 666, 667, figs. 2*).—The apparatus consists of 2 parts, an acid flask and a generator proper. The first is in the form of a wash bottle, the longer tube reaching down a little way into the acid and being connected at the other end, by means of a rubber tube, with the generator, so as to form a siphon. The generator is a Fresenius calcium chlorid tower, the material to be decomposed resting on a perforated floor just above the bottom. A tube at the top with a stopcock regulates the flow of gas. To put the apparatus in operation, open the cock and blow into the acid flask to fill the siphon. When the cock is closed the pressure drives the acid back into its flask, and by reason of its greater density it settles to the bottom without mixing with the other acid. To facilitate this a mantle tube surrounds the short arm of the siphon and reaches to the bottom of the flask. Openings at the top of this mantle allow fresh acid to enter it, so that fresh, unused acid is siphoned into the generator each time.—J. T. ANDERSON.

A new form of hydrogen generator, E. W. MAGRUDER (*Amer. Chem. Jour., 19 (1897), No. 9, pp. 810–812*).

A new support on the Bunsen burner, E. STEIGER (*Chem. Ztg., 21 (1897), No. 68, p. 668, figs. 3*).—The ordinary sheet-iron cone is replaced by a cylinder which is securely fastened in place by a screw, and on this cylinder the vessel to be heated is placed. Either a wire triangle, a wire gauze, or an asbestos plate may be used with it.—J. T. ANDERSON.

A new form of burette, C. SANDER-PRAYON-LEZ-TROOZ (*Chem. Ztg., 21 (1897), No. 74, p. 739, fig. 1*).

Laboratory work, P. BONAME (*Rap. An. Sta. Agron. [Mauritius], 1896, pp. 7–11*).—A brief summary of chemical work on soils, fertilizers, sugars, sirups, etc., during 1896. The valuation of fertilizers is briefly discussed.

The use of aluminum ware for domestic purposes, L. FRANCK (*Chem. Ztg., 21 (1897), No. 80, pp. 816–818*).

BOTANY.

An important function of leaves, U. SUZUKI (*Imp. Univ. Col. Agr. [Tokyo] Bul., vol. 3, No. 3, pp. 241–252*).—The author examined leaves of quite a number of species of plants to determine: (1) The decomposition of proteids and transportation of the decomposed products to other parts of the plant; (2) is the gradual oxidation of the amido acids observable? and (3) are the amido compounds, such as leucin and asparagin, better sources of nitrogen for the protein in fruits and roots than nitrates?

The experiments were conducted during September and October, the leaves being collected at 6 a. m. and 6 p. m., after having been exposed to approximately 12 hours of light or darkness. The total nitrogen, albuminoid nitrogen, asparagin nitrogen, and starch were determined.

The conclusions of the author seem to indicate that reserve proteids in the leaves are decomposed into amido compounds during the night and they are quickly transported to other parts of the plant. This important function of the leaves assists in facilitating the formation of proteids in all parts of the plant. The amido compounds are considered better sources for protein formation than the nitrates, especially in those organs of the plant which are poor in sugar and have little respiratory energy. This function is especially important in plants of rapid growth, as some of the legumes or in those developing large storage organs, as potatoes, turnips, melons, etc.

The amido compounds formed are either asparagin, which can be formed synthetically from ammonium salts as well as the nitrates, or they are decomposition products of proteids formed in the assimilation of nitrates.

On the behavior of active albumin as a reserve material during winter and spring, U. SUZUKI (*Imp. Univ. Col. Agr.* [*Tokyo*] *Bul., vol. 3, No. 3, pp. 253–258*).—The author examined the buds and bark of 48 species of trees and shrubs and found active albumin as a reserve material in 25 of them. It was frequently found more abundant in the bark than in the buds. In this respect it behaves like other reserve materials.

The details of the experiments are fully described.

On the physiological action of neutral sodium sulphite on phanerogams, K. NEGAMI (*Imp. Univ. Col. Agr.* [*Tokyo*] *Bul., vol. 3, No. 3, pp. 259–264*).—The effect of neutral sodium sulphite on various phanerogams was investigated. Solutions containing 1 per cent of neutral sodium sulphate were freshly prepared and changed every 2 days, since it oxidizes into sulphate very rapidly. Whole plants, branches, leaves, and seeds were experimented with and the poisonous effect of sodium sulphite upon developed plants was established. It seemed to have no noxious effect on the germination of radish and barley seeds, although the germination of soy beans was retarded to some extent.

The poisonous action of ammonium salts on plants, S. TAKABAYASHI (*Imp. Univ. Col. Agr.* [*Tokyo*] *Bul., vol. 3, No. 3, pp. 265–274*).—Experiments were conducted to test the effect of ammonium carbonate, sulphate, and chlorid on plant growth, comparing them with sodium carbonate and sulphate. A dozen or more kinds of plants were grown in culture solutions containing varying amounts of the chemicals. The experiments with barley, wheat, and onions are reported upon in considerable detail.

The method of experimentation was to keep half the objects in darkness until most of the reserve material was used up, the other portion being kept in the light for the same time in a solution containing cane sugar. When the reserve material was nearly exhausted both lots of plants were placed in the solutions containing the ammonium compounds and kept in darkness.

It was soon found that the sugar solutions checked the injurious action of the weaker ammonium solutions, but had little if any influence when the stronger (0.5 per cent) solutions were used. This action is explained by the greater osmotic action of the ammonium solutions. When the cells are already filled with sugar or glycerol the entrance of the injurious element is impeded.

The general conclusion is that, "From all the observations described, it follows that ammonium salts have a noxious action upon phanerogamous plants if there is not a sufficient quantity of sugar present in the plant. The sugar may convert the noxious ammonia into asparagin, and as a consequence the noxious action is not noticed in well-nourished plants."

The principal phenomena of the poisonous effect of ammonium carbonate were a loss of turgidity and softening of the roots, loss of turgidity and appearance of brown spots on leaves, and change of color in the culture medium due to discoloration from the dead cells of the plant.

Notes on the grasses and forage plants of Iowa, Nebraska, and Colorado, L. H. PAMMEL (*U. S. Dept. Agr., Division of Agrostology Bul. 9, pp. 47, figs. 12*).—The report given includes general observations of the author on the physical conditions and other important questions relative to forage production in the States named; an enumeration of the more important grasses and forage plants occurring in the States, with economic notes, and a classified list of the grasses collected by the author during the seasons of 1895 and 1896 in Iowa, Nebraska, and Colorado.

Notes on the plants used by the Klamath Indians of Oregon, F. V. COVILLE (*U. S. Dept. Agr., Division of Botany, Contributions from the U. S. National Herbarium, vol. 5, No. 2, pp. 87–108*).—The author gives notes on the economic uses of plants by the Klamath Indians of Oregon, based upon his observations while engaged in a botanical survey of the plains of southeastern Oregon in the summer of 1896.

Studies of Mexican and Central American plants, J. N. ROSE (*U. S. Dept. Agr., Division of Botany, Contributions from the U. S. National Herbarium, vol. 5, No. 3, pp. 109–144, pls. 16, figs. 6*).—Notes are given on a number of species of the orders Celastraceæ, Rutaceæ, Burseraceæ, and Cucurbitaceæ, and on miscellaneous genera and species; also synopses of the species of Heliocarpus, Wimmeria, the American species Hermmannia, and *Drymaria nodosa* and its allies, and descriptions of miscellaneous new species.

The vegetation of the Yellowstone Hot Springs, J. W. HARSHBERGER (*Amer. Jour. Pharm., 69 (1897), No. 12, pp. 625–634*).—Among other forms of plant life found growing in these hot springs the author mentions *Leptothrix laminosa* growing at 135 to 185° F., Phormidium at 165°, and Beggiatoa at 150 to 165°.

A revision of the species of Plantago occurring in the United States, A. M. CUNNINGHAM (*Proc. Indiana Acad. Sci., 1896, pp. 190–207, pl. 1*).—Two new species, *P. rubra,* separated from *P. virginica,* and *P. minima,* separated from *P. patagonica gnaphalioides,* are described.

Botany of pampas grass and its allies, O. STAPF (*Gard. Chron., 3. ser., 22 (1897), Nos. 569, p. 358; 570, p. 378*).—Notes are given of *Gynerium argenteum, G. saccharoides,* and their allies.

Investigation of important grasses at Bergshamra, C. E. BERGSTRAND (*Biet [Helsingfors], 18 (1897), No. 2, pp. 46–56*).—The yield, composition, and general value of the following grasses are considered: *Dactylis glomerata, Festuca pratensis, Avena elatior,* and *Phleum pratense.*

Cytological studies of fungi, A. N. BERLESE (*Riv. Patol. Veg., 6 (1897), No. 1–5, pp. 66–75*).—Cytological studies are given of *Oïdium monilioides* and *O. erysiphoides.*

The enzymic ferments in plant physiology, F. A. WAUGH (*Science, n. ser., 6 (1897), No. 156, pp. 950–952*).

Concerning the enzym of barley capable of dissolving the cell walls, F. REINITZER (*Ztschr. Physiol. Chem., 23, pp. 175–208*).

Concerning the organs of assimilation in the Asparagineæ, J. REINKE (*Jahrb. Wiss. Bot. [Pringsheim], 31 (1897), No. 2, pp 206–272, figs. 26*).—A critical study is given of the assimilatory organs of Asparagus and allied genera.

Soil inoculation with leguminous root tubercle bacteria, W. MEYER (*Ztschr. Offentl. Gesundheitpflege, 1897, No. 14, pp. 256–258*).

Concerning alinit, R. HARTLEB (*Bot. Centbl., 72 (1897), No. 7, pp. 229–231*).—This is an abstract of a paper read before the Botanical Section of the German Association of Naturalists and Physicians, in which an account is given of some investigations relative to alinit. The substance seems to be pure cultures of *Bacillus ellenbachensis.* Further investigations are said to be necessary to establish its value in practical agriculture.

Nitrogen and forest vegetation, E. HENRY (*L'azote et la végétation forestière. Nancy: Berger, Levrault & Co., 1897, pp. 23*).

Contribution to the subject of the assimilation of free nitrogen by mustard, T. PFEIFFER and E. FRANKE (*Landw. Vers. Stat., 48 (1897), No. 6, pp. 455–467*).—The authors claim that mustard must be included in the enumeration of those plants capable of assimilating the free nitrogen of the air.

Investigations concerning the origin and development of sex in Triticum with special reference to cell division, KÖRNICKE (*Verhandl. Naturhist. Ver. Preuss. Rheinlande, 53 (1896), pp. 149–185.*)

The physiological action of amido sulphonic acid, O. LOEW (*Jour. Col. Sci. Imp. Univ. Tokyo, 9, pt. 2, pp. 273–276; abs. in Bot. Centbl., 72 (1897), No. 6, pp. 204, 205*).

Buds and stipules, J. LUBBOCK (*Jour. Linn. Soc. Bot. [London], 33, No. 230, pp. 203–269, pls. 4, figs. 133*).—The concluding paper of the author's studies of buds and stipules.

Contractile roots and their function, A. RIMBACH (*Beitr. Wiss. Bot., 2. Abt., 1 (1897), pp. 28, pls. 2*).

The physiology of the nucleus, F. G. KOHL (*Bot. Centbl., 72 (1897), No. 5, pp. 168–170*).

The physiology of the vegetable nucleus, B. LIDFORSS (*Acta Reg. Soc. Phys. Lund, 8 (1897), pp. 26, pl. 1*).

The comparative anatomy of the Solanaceæ, F. FEDDE (*Inaug. Diss., Breslau, 1896, pp. 48; abs. in Bot. Centbl., 72 (1897), No. 4, pp. 144–147*).—The author has grouped the various genera according to their anatomical structure.

A contribution on the cause of water movement in plants, A. MAYER (*Forsch. Agr. Phys. [Wollny], 20 (1897), No. 2, pp. 213–216*).—A controversial article dealing with the theories of Boehm and others.

Concerning the amount of transpiration in a moist tropical climate, G. HABERLANDT (*Jahrb. Wiss. Bot.* [*Pringsheim*], *31* (*1897*), *No. 2, pp. 273–288*).

Concerning the transformation of fats during germination and their chemical and physiological significance (*Wchnbl. Brau., 14* (*1897*), *No. 39, pp. 488, 489*).

On the formation of albuminoids in plants, B. HANSTEEN (*Ber. Höiere Landbr. Skole i Aas, 1895–'96, pp. 214–217*).

The alkaloid of the black lupine, K. GERHARD (*Arch. Pharm., 235* (*1897*), *No. 5*).

Concerning the alkaloid of the perennial lupines, K. GERHARD (*Arch. Pharm., 235* (*1897*), *No. 5*).

On the effect of alkaloids on plants in the light and darkness, G. SCHWARTZ (*Inaug. Diss., Erlangen, 1897, pp. 49*).

On the influence of light on growth, K. STAMEROFF (*Flora, 83* (*1897*), *pp. 135–150; abs. in Bot. Centbl., 72* (*1897*), *No. 5, p. 179*).—The author found that the vegetative hyphæ of Mucor and Saprolegnia grew equally well in light and darkness, while the growth of the reproductive hyphæ of Mucor was checked in the light. The rhizoids of Marchantia grew better in light than in darkness. The pollen tubes of *Colutea arborescens* and *Robinia pseudacacia* did not grow in the light. The pollen tubes did not make equal growth and it was largely controlled by the amount of sugar in the medium.

Concerning the specific heat of plants, H. SIMMER (*Allg. Bot. Ztschr. Syst. Flor. Pflanzengeog., etc., 3* (*1897*) *No. 10, pp. 160–163*).

FERMENTATION—BACTERIOLOGY.

On the origin of sake yeast, K. YABE (*Imp. Univ. Col. Agr.* [*Tokyo*] *Bul., vol. 3, No. 3, pp. 221–224*).—The author has investigated the origin of sake yeast (*Saccharomyces sake*) which develops so rapidly in certain stages of sake brewing. The hypothesis that it is derived from *Aspergillus oryzæ* is not accepted, pure cultures of that fungus proving incapable of forming the yeast cells. Examinations made of air in the botanic garden, while showing numerous fungi, did not include any sake yeast. Yeast cells were found in considerable number in the cellars where the fermenting rice is kept. A sterile plate 9 cm. in diameter exposed for 30 minutes to the air of the cellar contained, after 76 days, 207 colonies of Penicillium, 76 of Aspergillus, and 36 of yeast. The source whence the yeast came into the cellar is stated to be the rice straw, mats of which are extensively used in the first stage of sake manufacture. Examinations made of rice straw from mattings in the cellar, from fresh straw from the fields, and from soil from rice fields all showed the presence of the sake yeast.

The sake yeast cells are globular or slightly elipsoid in form, 5 to 9μ in diameter, usually 7μ. In budding the cells soon separate, seldom or never forming the long chains seen in some yeasts.

The yeast forms on gypsum blocks, but not in the fermenting liquid, 1 to 3 ascospores, a previous good nutrition rather rich in protein being necessary to ascospore formation. The author has not proved that the ascospores are capable of producing the yeast cells. No trace of anything resembling a mycelium, as claimed by Korschelt,[1] was observed.

Sake yeast is said to be capable of continuing fermentation in the

[1] Mit. Gesell. Ostasien, Tokyo, 1878.

presence of 12 per cent alcohol and feebly at 16 per cent. Small quantities of some of the higher alcohols check its growth. Cane sugar solutions containing meat extract are fermented by it even when containing as much as 45 per cent cane sugar. Salt in small quantity does not check it, while 22 per cent stops it entirely. Solutions containing 10 per cent cane sugar and 4 per cent tartaric acid do not admit the growth of the yeast.

Several other agents of fermentation derived from rice straw are mentioned, among them the organism depended upon for ripening the vegetable cheese, natto, the Javanese arrac, a diastase-yielding fungus and *Saccharomyces vordermanni.*

On the behavior of yeast at a high temperature, T. NAKAMURA (*Imp. Univ. Col. Agr.* [*Tokyo*] *Bul., vol. 3, No. 3, pp. 227–232*).—The author experimented with pure cultures of yeast obtained from a single colony. A description of the method of treatment is given. It was found that exposing the yeast in a water bath for 1½ hours at 46° C. or 1 hour at 48° C. did not destroy its fermenting power. At a temperature of 52° C. the power to produce fermentation was destroyed if continued for more than 20 minutes.

It was found that the thermal point at which the fermenting power was destroyed was 50° C. for 30 minutes' exposure. With between 25 and 30 minutes' exposure at the above temperature, the yeast still gave feeble fermentation for a short time, after which it ceased, although but a very small portion of the sugar had been used up. It is inferred that exposure for 25 minutes to a temperature of 50° C. forms the limit, not only of fermenting power, but life functions as well.

The effect on the resistant power of the organism of adding various compounds to the culture medium was tested and meat extract, sodium chlorid, and sodium nitrate served to increase the resisting power of the yeast.

In an appended note by Dr. O. Loew, the phenomenon of suspended fermenting power in living cells is explained by the statement of Buchner [1] "That the fermentative power is connected with a soluble proteid that can be separated by expressing the yeast under a pressure of 400 to 500 atmospheres." This substance, called zymose, coagulates easily, and after a few days loses its active properties. It is similarly affected by heating to 50° C. or more.

Note on a grape wine fermented by sake yeast, K. NEGAMI (*Imp. Univ. Col. Agr.* [*Tokyo*] *Bul., vol. 3, No. 3, pp. 225, 226*).—Two liters of freshly prepared grape juice were sterilized by boiling and after cooling inoculated with a pure culture of sake yeast. After 2 months fermentation at from 5 to 20° C., the clear filtered liquid gave extract 1.78 per cent, acidity 0.572 per cent, alcohol 10.30 per cent. The taste was equal to that of the average white wine, but the bouquet was inferior. The yeast can not be used to replace the usual ferments of wine making.

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[1] Ber. Deut. Chem. Gesell., 30 (1896), p. 117.

Bromalbumin and its behavior toward microbes, O. LOEW and S. TAKABAYASHI (*Imp. Univ. Col. Agr.* [*Tokyo*] *Bul., vol. 3, No. 3, pp. 237–240*).—On account of the recommendation of some medical practitioners of bromalbumin to secure immunity from certain bacterial diseases, the authors were led to investigate its action. Fresh material, which is an organic compound of bromin, was prepared and tested upon the bacteria of putrefaction and the bacillus of anthrax. It was found in the absence of air to be somewhat unfavorable to the development of the bacteria. When peptones were present, it did not prevent growth. Preliminary experiments with mice showed that subcutaneous injections of bromalbumin did not secure immunity from anthrax and erysipelas.

Two new kinds of red yeast, K. YABE (*Imp. Univ. Col. Agr.* [*Tokyo*] *Bul., vol. 3, No. 3, pp. 233–236*).—The author describes 2 new species of red yeasts, *Saccharomyces japonicus* and *S. keiskeana*. They were found on rice straw and soil of rice fields, and are closely related to *S. rosaceous*.

Notes on fermentation, I. J. HAGE (*Arch. Gen. Med., 1897, pp. 157–165*).

Progress in the chemistry of fermentation, E. BUCHNER (*Tubingen, 1897, pp. 23; abs. in Bot. Centbl., 71 (1897), No. 1, pp. 38, 39*).

A manual of bacteriology, R. MUIR and J. RITCHIE (*London: Pentland, 1897, pp. 538, figs. 108*).

A new growth form of Nitroso-bacterium, W. RULLMANN (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 9–10, pp. 228–231, fig. 1*).

The longevity of bacteria in dust and soil, P. MIQUEL (*Ann. Microg., 1897, No. 6, pp. 251–259*).

Contribution to the knowlege of the bacteria of acetic fermentation, W. HENNEBERG (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 9–10, pp. 223–228*).

A contribution to the bacteriology of bread, J. SCHRANK (*Ztschr. Allg. Österr. Apoth. Ver., 1897, No. 14*).

On the physiology and morphology of the acetic acid bacteria, W. SIEFERT (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), Nos. 13–14, pp. 337, 349; 15–16, pp. 385–399*).

New methods of bacterial investigation, N. J. C. MÜLLER (*Stuttgart: E. Nägele, 1897, pt. 1, pp. IV, 96, col. pls. 20*).—Reprinted from *Beiträge zur Wissenschaftlichen Botanik* for 1897.

Pathogenic bacteria of water, H. M. WARD (*Proc. Roy. Soc.* [*London*] *61, (1897), pp. 415–423*).—Some 80 forms are considered in the author's paper. These are arranged for investigatorial purposes into groups, each of which contains a type that is regarded by the author as probably a species of which the others are but varieties. It is noted that the effect of definite changes in the environment of the media and on the growing organism are very important; and, further, that this importance is not generally sufficiently recognized.

The influence of the X-rays on bacteria, G. SORMANI (*Rend. R. Inst. Lombardo Sci. e Let., 2. ser., 29 (1896), pp. 517–520; abs. in Jour. Roy. Micros. Soc.* [*London*], *1897, No. 5, p. 425*).—From experiments with 16 species of bacteria, most of which were pathogenic, it was found that the pathogenic action of cultures exposed to X-rays is not diminished.

Concerning the effect of electric currents on microorganisms, R. HELLER (*Oesterr. Bot. Ztschr., 47 (1897), No. 9, pp. 326–331, fig. 1*).

On the germicidal action of tannin, G. GOEGG (*Ann. Microg., 1897, No. 2–3, pp. 49–144*).

A text-book on bacteriology, E. M. CROOKSHANK (*London: H. G. Lewis, 1896, pp. 715, pls. 22, figs. 273*).—This important work discusses the etiology and prevention of infectious diseases, and gives also an account of yeast, hæmotozoa, psorosperms or coccidia, bacteriological parasites, and reagents. In a supplementary appendix are given extracts from the report of the Royal Vaccination Commission for 1896. The distinctive features of various pathogenic bacteria and their cultures are brought out in colors. The contagious diseases of animals are treated, and the most stringent measures insisted upon in combating them. The carcasses of animals that have died of anthrax, for instance, should, one is told, be buried deep and with a liberal use of lime in and around the hole. The spot where the animal died should be sprinkled with lime and fenced off for some time. The carcass should by no means be allowed to get into a stream.

In discussing tuberculosis, the congenital transmission of the disease is insisted on in a way that would lead one to infer that such transmission is more common than American and Russian experiments indicate. But no experimental evidence is cited.

Studies of lactic acid yeasts, J. EFFRONT (*Alkohol, 7 (1897), No. 18, pp. 276, 277*).

Influence of certain conditions of artificial media upon individual variation, J. KUNSTLER (*Rev. Sci. [Paris], 4. ser., 7 (1897), No. 25, pp. 771–774*).

Concerning a soluble enzym in the cells of barley (*Ztschr. Physiol. Chem., 23 No. 2, pp. 175–208*).

A new method of sterilization by heat under pressure, W. KÜHN (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 9, pp. 470, 471*).

A simple method of preparing nutrient agar, H. B. SHEFFIELD (*Merck's Rpt., 6 (1897), No. 24, p. 762*).

Paraffin sectioning technique, F. BLOCHMANN (*Ztschr. Wiss. Micros., 14 (1897), No. 2, pp. 189–195, fig. 1*).

A process for rapid microscopical investigation of bacteria in cover-glass and glass-slide preparations, D. KISCHENSKY (*Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No. 22–23, pp. 876, 877*).—A drop of pure culture is placed in a drop of weak carbol-fuchsin (10 drops in 10 cc. water) on a cover glass and fixed, stained, and dried at the same time in the flame of a lamp. All 3 processes thus combined require only a few seconds. When dealing with bacteria in feces and urinal sediment, it will be found better, it is said, if with the carbol-fuchsin an alcoholic solution of methylene blue be mixed.

On a special procedure for staining bacteria in cover-glass preparations and in sections, W. SEMENOWICZ and E. MARZINOWSKY (*Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No. 22–23, pp. 874–876*).—In cover-glass preparations the cover glass is left for 2 minutes in carbol-fuchsin, consisting of the ordinary concentrated solution diluted to one-half with water. It is then washed in water and afterwards stained for 3 to 4 minutes with Loeffler's methylene blue. Sections are allowed to remain in the carbol-fuchsin 4 to 5 minutes, and for the same length of time in methylene blue. The preparations are then in both cases mounted in Canada balsam by the usual methods. The bacteria stand out strongly in the preparations as blue objects on a red or rosy background. The essential usefulness of the method is thought to lie in the fact that the methylene blue causes a change in the carbol-fuchsin, appearing in the nuclei and bacteria sooner than in the cytoplasm of the cells or in the connective tissues. As methylene blue does not act so alone, it appears that the carbol-fuchsin has the action of a mordant. But if the carbol-fuchsin be replaced by 5 per cent carbolic acid, and specimens treated for 5 minutes therein, the bacteria and nuclei become more deeply stained than by methylene blue alone. But a good staining may be obtained with carbol-fuchsin. Hence the author thinks that it is the fuchsin that acts as a mordant.

Chemical disinfection, A. GAWALOWSKI (*Ztschr. Nahr. Untersuch. u. Hyg., 11 (1897), No. 14, p. 233*).—A table is given showing the relative value of a number of substances as deodorants, disinfectants, and antiseptics.

A method of staining flagella, D. MCCRORIE (*Internat. Jour. Micros. and Nat. Sci., 3. ser., 7 (1897), No. 35, pp. 212, 213*).—The objects are stained in a mixture composed of concentrated alcoholic solution of "night blue" 10 cc., 10 per cent solution of alum 10 cc., and 10 per cent solution of tannic acid 10 cc. One-tenth to two-tenths gram of gallic acid may be added as a mordant, but good results may be obtained without it.

ZOOLOGY.

Animals useful and injurious to horticulture, A. LARBALÉTRIER (*Les animaux utiles et nuisibles à l'horticulture (insects exceptcs). Paris: Octave Doin, 1897, pp. 153, figs. 29*).—This excepts the groups of insects and treats of the mammals, birds, batrachia, reptiles, arthropoda other than insects, worms, and mollusks, that may be considered either injurious or useful to horticulture. The habits of the animals, their characteristics, the character of the damages done by them, their general habits, and means for protection against them are briefly brought out.

Among myriapods Geophilidæ are described as injurious to the tubers of certain plants such as the potato. Kirby is quoted as authority for the statement that they live in galleries in the roots of these plants. The species mentioned is *Geophilus longicornis*, and along with it as a companion is noted *Polydesmus complanatus*. *Julus terrestris* is noted as injurious, and also *Glomeris marginata*, Savigny's cryptops, and *Lithobius forficatus*. The very beneficial earthworm (*Lumbricus terrestris*), where it is very numerous, is considered something of a pest.

Laboratory directions in general biology, H. RANDOLPH (*New York: Henry Holt & Co., 1897, pp. 162*).—This is a student's handbook of directions for a full year's course in general biology, in which 6 hours per week of work is expected. As an aid to the teacher, the proportionate amount of work to be devoted to each subject is tabularly set forth. The laboratory directions, which are brief, begin with the fern, which is followed by the earthworm. To each of these subjects 10 hours are devoted. Then follow the amœba, white blood corpuscle, hæmatococcus, paramecium, vorticella, penicillium, lichens, mushrooms, bacteria, spirogyra, hydra, muscle, lobster, etc. The work finally ends with directions for a brief study of the embryology of the chick.

METEOROLOGY.

United States daily atmospheric survey, W. L. MOORE (*U. S. Dept. Agr., Weather Bureau Doc. 138, pp. 6*).—This is a reprint of a paper read before the geographical section of the British Association for the Advancement of Science, Toronto, August 23, 1897.[1]

"The vast region now brought under the dominion of twice-daily synchronous observations embraces an area extending 2,000 miles north and south, 3,000 miles east and west, and so fortunately located in the interest of the meteorologist as to cut an important arc from the circumpolar thoroughfare of storms of the Northern Hemisphere. The extreme points of observation are Edmondton, in the Canadian Province of Alberta, on the northwest; St. Johns, on the northeast; Key West, on the southeast, and San Diego on the southwest; and arrangements are now complete for a cooperation with Mexico similar to that in operation with Canada, which will in a few months extend the area of observation southward over Mexico and Yucatan."

The opinion is expressed that by means of this system of observations the highest degree of accuracy in making forecasts possible to be attained with surface readings has been reached.

The Weather Bureau has undertaken "to systematically attack the problem of upper-air exploration, with the hope ultimately of being

[1] Nat. Geog. Mag., 8 (1897), pp. 299–303.

able to construct a daily synoptic weather chart from simultaneous readings taken in free air at an altitude of not less than one mile above the earth." The success in this line has been such that it is probable that in a short time there will be "not less than 20 stations placed between the Rocky Mountains and the Atlantic Ocean, taking daily readings at an elevation of 1 mile or more."

"We shall then construct a chart from the high-level readings obtained at these 20 stations and study the same in connection with the surface chart made at the same moment. Being thus able to map out not only the vertical gradients of temperature, humidity, pressure, and wind velocity, but the horizontal distribution of these forces on two levels, it is hoped to better understand the development of storms and cold waves and eventually improve the forecasts of their future course, extent, and rate of movement."

Report of the Chief of the Weather Bureau for 1897, W. L. MOORE (*U. S. Dept. Agr., Weather Bureau Doc. 139, pp. 28*).—A summary report of the operations of the Weather Bureau during the fiscal year ending June 30, 1897, covering the following topics: Comparison of cost and efficiency of the Weather Service, 1883–'84 and 1896–'97; appropriations for 1898; forecasts (destructive storms of the year, flood warnings, and flood in the lower Mississippi); hydrography (description of the river system); cold-wave and frost warnings; distribution of forecasts and warnings; distribution of weather statistics by maps; climatic work, cotton, corn, and wheat region services; publications; original investigations and reports; climatology, studies of sunstroke and weather conditions; rainfall of the United States; some climatic features of the arid region; storms, storm tracks, and weather forecasting; aerial work; improvements in kite construction; the object of kite flying; and cloud work.

Instructions for use of aneroid barographs on the Great Lakes, W. L. MOORE (*U. S. Dept. Agr., Weather Bureau Doc. 132, pp. 7, fig. 1*).—The aneroid barograph is described and directions are given for its use.

Weather record for 1896 at Newport, Arkansas (*Arkansas Sta. Bul. 46, p. 100*).—A tabular record is given of maximum and minimum temperatures and rainfall for each day of the 5 months, April–August, 1896.

WATER—SOILS.

Soil moisture during the crop season of 1896, M. WHITNEY and R. S. HOSMER (*U. S. Dept. Agr., Division of Soils Bul. 9, pp. 23, dgms. 12*).—This is a continuation of work begun in 1895.[1] "In a number of cases the records were continued in the same places as in the previous year, but in order to extend the preliminary investigations over a wide range of soil conditions, some of the observations were discontinued and other areas were taken up." The method of determining moisture was the same as that used in 1895.[2] The results, however, are reported

[1] U. S. Dept. Agr., Division of Soils Buls. 1, 2, and 3 (E. S. R., 7, pp. 483, 847).

[2] U. S. Dept. Agr., Division of Soils Bul. 4 (E. S. R., 8, p. 481).

on the basis of dry weight of soil, a table being given by which percentages calculated on the fresh weight may be converted into those calculated on the dry weight.

Tables and diagrams show the daily variation in the moisture content of the soil during April to September in early truck land at Mardela Springs, Maryland; blue grass (Trenton limestone) land at Lexington, Kentucky; cotton land (Red Hill formation) at St. Matthews, South Carolina; sandy cretaceous cotton land at Union Springs, Alabama; sandy cretaceous cotton land at Fort Deposit, Alabama; black cretaceous prairie at Macon, Mississippi; black clay of the Mississippi bottom at Greenville, Mississippi; black waxy soil at Paris, Texas, and prairie land at Colby, Kansas.

"Curves illustrate in a graphic way the conditions in several soils during a period of quite marked drought, during which crops suffered, in the season of 1896." These and other data in the case of some of the soils which have been studied for some time under different weather conditions have been used as a basis for approximately establishing lines of excessive moisture and of drought in the soils.

Researches on the drainage waters of bare and cultivated soils, P. P. DEHÉRAIN (*Ann. Agron., 23 (1897), No. 6, pp. 241–267*).—This is a summary of observations on the vegetation boxes at Grignon during 5 years.[1] The results clearly demonstrate that the quantity of nitrates removed by the drainage water from bare soils is very much greater than that removed from soils covered with a crop, and this discrepancy is not in every case entirely accounted for by the amount of nitrates utilized by the plant.

From the data obtained in experiments with wheat, it is estimated that the amount of nitric nitrogen utilized by the crop and removed in the drainage water was only 94 kg., while the amount of nitric nitrogen found in the drainage water from a check plat of bare soil was 200 kg. The wide discrepancy in this case may be partially accounted for by the fact that during a part of the growing season of the wheat the moisture was not sufficient for the needs of the crop and for active nitrification in the soil. In experiments with corn, during the growing season in which the rainfall was abundant, the amount of nitric nitrogen utilized by the crop and found in the drainage water was 197 kg., as compared with 200 kg. found in the drainage water of bare soils.

These results show in general that the soils experimented on are capable, with a sufficient supply of moisture, of furnishing all the nitrates required by the largest crops, and indicate that if provision were made for a sufficient supply of irrigation water at all periods of the growing season, nitrification would be so promoted that much smaller applications of nitrogenous fertilizers would be required.

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[1] For abstracts of previous work in this line see E. S. R., 6, p. 977.

Production of humus from manures, H. SNYDER (*Minnesota Sta. Bul. 53, pp. 12–35, fig. 1*).—This is a continuation of previous work.[1] In order to study the variation in composition of humus and humates of different origin these products were prepared from known materials in the following way: 200 gm. of sugar was mixed with 3,000 gm. of soil containing a small known amount of organic matter, placed in a tight box, and allowed to undergo decomposition out of doors for one year. Humus was produced in the same way from cow manure, green clover, meat scraps, wheat flour, sawdust, oat straw, and asparagin. The humus produced was extracted from the soil, after treatment with dilute hydrochloric acid and distilled water, with a 3 per cent solution of potassium hydroxid. The precipitates obtained by neutralizing with hydrochloric acid were washed, dried, and analyzed. The results are given in the following table:

Composition of humus produced by different organic substances.

	Cow manure.	Green clover.	Meat scraps.	Wheat flour.	Oat straw.	Sawdust.	Sugar.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Carbon	41.95	54.22	48.77	51.02	54.30	49.28	57.84
Hydrogen	6.26	3.40	4.30	3.82	2.48	3.33	3.04
Nitrogen	6.16	8.24	10.96	5.02	2.50	.32	.08
Oxygen	45.63	34.14	35.97	40.14	40.72	47.07	39.04
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

This table shows wide variations in the composition of humus produced by the decomposition of different materials. None of the materials analyzed agreed in composition with the formulas in Mulder's classification, and "it is evident that any formulas applied to the compounds as a whole would, to say the least, fail to express the composition of humus."

"It would seem best, in the present state of our knowledge of the humus compounds, to make the division on the basis of the nitrogen content; that is, divide the humus compounds into classes, as follows:

"(1) Non-nitrogenous group, as sugar humus. (2) Humus containing 1 to 2 per cent nitrogen, as sawdust humus. (3) Humus containing 2 to 4 per cent nitrogen, as oat-straw humus. (4) Humus containing 4 to 8 per cent nitrogen, as flour and cow manure humus. (5) Humus containing over 8 or 9 per cent nitrogen.

"Such a division would give an approximate idea as to the nature of the material from which the humus has been produced, as well as an approximate idea of its agricultural value. . . .

"The humate compounds do not form well-defined crystallized bodies, and it is almost impossible to obtain any one of these compounds in a pure state, to study the structural composition."

In order to decide whether the mineral constituents found in humus are furnished entirely by the mineral matter in the humus-forming material or are partly derived from the soil by the chemical action of the humus, the phosphoric acid and potash in the soil and humus-forming materials at the beginning of the experiment and in the humus

[1] Minnesota Sta. Buls. 30 and 41 (E. S. R., 5, p. 857; 7, p. 476).

obtained were determined. The results are summarized in the following table:

Phosphoric acid and potash in humates produced by different materials.

	Phosphoric acid.		Potash.	
	In original materials.	In final product.	In original materials.	In final product.
	Grams.	*Grams.*	*Grams.*	*Grams.*
Cow-manure humus	1.17	1.62	1.06	1.27
Green-clover humus	3.21	3.74	5.26	4.93
Meat-scraps humus	1.07	1.18	.25	.36
Sawdust humus	.85	.78	.67	.70
Flour humus	.60	.71	.32	.48
Oat-straw humus	1.02	1.03	2.42	2.41

This table shows that there is a wide difference in the power which various humus-forming materials possess of forming humates with the mineral matter of the soil. The nitrogenous materials appear to be most active in this respect. There is also a great difference in the readiness with which soils combine with the humus.

Analyses of the humus of new and old soils are reported which show that "in the long-cultivated soil the humus contains more carbon and holds less nitrogen and mineral matter in chemical combination than in the new soil."

The influence of different methods of farming on the humus content of the soil, the effect of forest fires, and the humus requirements of soils are briefly discussed; and the average composition of the mineral matter of the humus of a large number of samples of soils is reported.

Production of ammonia at the expense of organic matter and humus, E. BRÉAL (*Ann. Agron., 23 (1897), No. 8, pp. 356–369*).—A series of determinations of ammonia in plants and soils treated in different ways are reported, which led to the following conclusions:

(1) Ammonia is produced in soils and in plants in which growth has been checked. A plant in vigorous growth does not produce ammonia.

(2) Ammonia appears in the tissues of plants in a few hours if they are deprived of air or treated with anæsthetics, such as ether or chloroform.

(3) Air-dry vegetable matter with a limited supply of air evolves ammonia.

(4) In the presence of water not only plant remains but such stable nitrogenous substances as feathers, wool, horn, and leather give off ammonia.

(5) The humus of the soil also becomes a source of ammonia when it is brought in contact with leaves in which fermentation has been set up by a vegetable infusion.

(6) A fragment of leaf not only produces ammonia in the soil, but it is possible to measure the amount produced if the soil has previously been sterilized.

(7) Manure not only evolves ammonia itself, but also causes the production of ammonia by the humus of the soil.

(8) Plants absorb ammonia supplied to their roots. This is shown by

the accumulation of ammonia in the roots when the upper part of the plant is removed.

(9) When roots detached from the stems are brought in contact with the nitrogenous matter of the soil they form ammonia at the expense of this matter.

(10) A plant rooted in the soil has been found to produce more ammonia at the expense of the soil than it was able to utilize.

Soil improvement, R. L. BENNETT, G. B. IRBY, and C. L. NEWMAN (*Arkansas Sta. Bul. 46, pp. 79–99, fig. 1*).—The results of experiments during the past 6 years on the improvement of worn cotton soil and the best form and manner in which to apply fertilizers are summarized and the results of experiments during 1896 along this line at the northeast substation at Newport and the southern substation at Camden are reported.

Past experiments have indicated that "(1) Worn cotton soils need nitrogen, vegetable matter, better tillage, and better protection. (2) The cheapest, most durable, and available form to apply nitrogen is vegetable nitrogen in the form of cowpeas, cotton seed, and cotton-seed meal. (3) One crop of cowpeas turned in the soil will furnish more nitrogen than is necessary for one crop of corn or cotton. (4) Most Arkansas clayey soils do not need an addition of potash and phosphoric acid for staple crops if the soil's supply of those foods is made available and increased and the soil water increased by thorough and continuous tillage and by rotation with cowpeas. The exception to this is the deficiency of available potash and phosphoric acid in the sandy pine soils of South Arkansas. On that soil it may be profitable to use potash and phosphoric acid to a limited extent, but only after first testing to ascertain that extent. (5) Kainit and acid phosphate, 13 per cent and 14 per cent available, are the best forms in which to purchase potash and phosphoric acid."

The experiments at Newport were undertaken to ascertain the value of commercial fertilizers, cotton-seed meal, and barnyard manure for cotton and for corn and the effect of rotation on these crops. Three experiments were made with the same kinds and amounts of fertilizers. In experiment No. 1 the crop was grown after 2 crops of cotton, in experiment No. 2 after 2 crops of turned-under cowpeas, and in experiment No. 3 on worn cotton soil after a crop of peas and a crop of cotton. The following table shows the results:

Results of fertilizer experiments at Newport, Arkansas.

Fertilizers applied per acre.	Yield per acre.		
	Experiment 1, seed cotton.	Experiment 2, seed cotton.	Experiment 3, corn.
	Pounds.	*Pounds.*	*Bushels.*
No fertilizer	932	1,304	20
Nitrate of soda, 200 lbs., 16 per cent nitrogen	1,145	1,265	32
Muriate of potash, 300 lbs., 49 per cent potash	950	1,329	13
Acid phosphate, 300 lbs., 14 per cent phosphoric acid	960	1,381	19
Gypsum, 500 lbs	852	1,315	14
Cotton-seed meal, 400 lbs., 6 per cent nitrogen	1,080	1,213	29
Kainit, 400 pounds, 13 per cent potash	840	1,134	15
Barnyard manure, 10 loads	1,122	1,207	26

Plats manured with nitrogenous fertilizers gave the best results, but in experiment No. 2 all the fertilizers had very little, if any, effect.

No advantage was gained by applying potash, phosphoric acid, and lime to a crop of peas to be used by them before turning under for cotton and corn instead of applying these fertilizers directly to the corn or cotton crop.

Manure experiments with wheat on sandy soils showed that peas planted July 31 and turned under green October 10 were more effective than commercial fertilizers and even horse manure.

Cowpea vines turned under and cotton meal were more effective for grass, clover, and potatoes on worn cotton soils than commercial fertilizers, "showing . . . the soil's need of vegetable matter and nitrogen." Rotation experiments proved cowpeas a very effective renovating crop for worn cotton soils.

At the Camden substation a complete fertilizer produced better crops of cotton and Whip-poor-will peas than incomplete fertilizers. Various fertilizers were applied to Spanish peanuts, but the crop was attacked by disease and part of the peanuts rotted, although "the acid phosphate and kainit plats were practically all sound."

A note is given on the value of soil tests with fertilizers.

Composition of humus, H. Snyder (*Jour. Amer. Chem. Soc., 19 (1897), No. 9, pp. 738–744*).—This is an abridgment of an article in Minnesota Station Bulletin 53 (see page 632).

FERTILIZERS.

The decomposition of nitrates by bacteria, A. Stutzer and H. Jensen (*Deut. Landw. Presse, 24 (1897), No. 73, p. 665*).—Experiments are reported which throw light on the behavior of denitrifying organisms in different kinds of manure, to which attention has recently been called by the work of Maercker and Wagner.[1] These experiments indicate that these organisms are incapable of reducing nitrates except in the presence of a sufficient supply of assimilable carbon compounds to supply energy. If such a source of energy is lacking the nitrates remain unaltered, although the denitrifying organisms may be present in abundance. The fact observed by Maercker that horse manure is more active in causing denitrification in the soil than the manure of sheep or cows is explained by the fact that horse manure is much richer in assimilable carbon compounds than the other manures. The mechanical condition of the horse manure also is such that it is more uniformly and rapidly distributed in the soil than the other kinds.

Samples of horse and cow manure were shaken up in water containing a small amount of nitrates, parallel series of tests being made, in one of which easily assimilable carbonaceous matter was added in the form of glycerin. It was observed that the horse manure without the addition of carbonaceous matter destroyed the nitrates much quicker

[1] Landw. Vers. Stat., 48 (1897), pp. 163–260 (E. S. R., 8, p. 872).

than the cow manure, and that the addition of glycerin resulted in a most marked increase in the activity of the denitrifying organisms in both kinds of manure. It was observed further that after a time denitrification ceased, although nitrates were still present, but it commenced again immediately on the addition of more glycerin.

The authors observed that when straw was put into a solution of nitrates the nitrates were destroyed but that denitrification did not start immediately. It was shown in this case by experiments similar to those reported above that the inactivity of the denitrifying organisms at the beginning was due to an insufficiency of assimilable carbonaceous matter. This was supplied to them only after the straw had undergone partial decomposition. When glycerin was mixed with the nitrate solution the denitrification began immediately on the immersion of the straw in the solution; or if partially decomposed straw was used denitrification began at once.

Fertilizers (*New Jersey Stas. Rpt. 1896, pp. 19–110*).—Most of the material in this article has already been published.[1] Statistics are given of the quantity and value of fertilizers used in New Jersey during 1895, comparing the trade of this year with that of preceding years. The market prices of various fertilizing materials are reviewed, with trade values of fertilizing ingredients for 1896, and analyses and valuations are given of 495 samples of fertilizing materials, including nitrate of soda, sulphate of ammonia, dried blood, dried and ground fish, tankage, ground bone, dissolved South Carolina rock phosphate, Thomas slag, muriate of potash, sulphate of potash, kainit, ashes, nitrate of potash from tobacco extracts, tobacco stems, marl, stone lime, crematory garbage, wool waste, sea pumpkin, and home-mixed and factory-mixed fertilizers.

A review of market prices of fertilizing materials for 7 years shows that the difference between wholesale and retail prices of nitrogen in 1895 was 26.5 per cent. "This is much wider than ever before and is largely due to the unusually low wholesale prices which ruled for all ammoniates during 1895. In the case of available phosphoric acid the difference has been diminished about 21 per cent, while in potash there is a slight increase of 1 per cent."

The following table shows the deficiencies of the various brands examined in 1895 and 1896:

Agreement of actual composition with guaranteed composition of fertilizers, 1895 and 1896.

Year.	Brands examined.	Found as guaranteed.	Found deficient.	Number of deficiencies.		
				Nitrogen.	Phosphoric acid.	Potash.
1895	269	158	111	17	72	37
1896	329	211	118	30	52	56

[1] New Jersey Stas. Bul. 117 (E. S. R., 8, p. 966).

Practically four-fifths of the brands of fertilizers examined contained as much total plant food as was guaranteed, but in many cases it was not distributed in the proportions claimed.

The availability of organic nitrogen (*New Jersey Stas. Rpt. 1896, pp. 110–117*).—Two artificial methods for determining the availability of organic nitrogen in fertilizing materials were tested, namely, digestion in acid pepsin solution[1] and treatment with permanganate of potash according to Hayes.[2]

The first was tested on 49 brands of commercial fertilizers, and on samples of bone sawings, steamed bone, cotton-seed meal, dried ground fish, tobacco dust, king crab (*Limulus polyphemus*), wool waste, hoof meal, and certain special mixtures of ground hoof, tankage, leather, ground horn, dried blood, sodium nitrate, ammonium sulphate, potassium chlorid, and acid phosphate.

Twelve per cent of the fertilizers examined showed a suspiciously low solubility of nitrogen (50 per cent and less). The results of the other tests "confirm on the whole the general belief that the nitrogen of ground bone, blood, cotton-seed meal, and high-grade tankage possesses a high degree of availability [77.1 to 94.5 per cent]; they also show that the nitrogen of dried fish, tobacco dust. king crab, and hoof meal is considerably less available [52.3 to 70.9 per cent], while that of wool waste, raw leather, and ground horn is of very inferior quality [14.9 to 29.9 per cent]."

The results of these tests are compared with those of vegetation experiments on maize and oats made by the Connecticut State Station in 1894 and 1895.[3] The data thus obtained show that—

"With the exception of raw leather, the pepsin method tends to give lower results than were secured by the vegetation tests. The pepsin results, however, are quite satisfactory, except in the case of hoof meal, where the pepsin solubility is nearly 23 per cent lower than by the actual culture test. These results, therefore, confirm the conclusions of other investigators, namely, that, 'in general, the solubility of the nitrogen of these samples in pepsin solution was a fairly good measure of the relative availability of the nitrogen to the plant under the conditions of the vegetation experiment.' In hoof meal, however, the solubility of the nitrogen in pepsin solution is no indication whatever of its relative availability."

The Hayes method was tested on 4 samples of complete fertilizers; on dried blood, tankage, hoof meal, and raw leather in mixtures; and on dried fish and steamed bone alone. Two solutions were used, one prepared by dissolving 16 gm. of potassium permanganate and 200 gm. of potassium hydroxid in 1 liter of water, the other by dissolving 16 gm. of permanganate in 1 liter of 10 per cent sulphuric acid.

"The results secured both by the acid and alkali digestions are very satisfactory. When digested in alkali solution hoof meal and raw leather give too high results while in acid solution all agree closely in comparison with the vegetation tests,

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[1] Connecticut State Sta. Rpt. 1893, p. 218 (E. S. R., 6, p. 130).
[2] U. S. Dept. Agr., Division of Chemistry Bul. 47, p. 112 (E. S. R., 8, p. 26).
[3] Connecticut State Sta. Rpt. 1895, p. 112 (E. S. R., 8, p. 387).

except steamed bone, which is too low. These results are too few for any definite conclusions to be drawn from them, but those secured by the acid digestion are very encouraging, and this method, possibly with some modifications, promises at least a partial solution of the problem of a laboratory method for determining the availability of organic nitrogen."

Pond cleanings, P. BRIDGE (*Farm and Home, 16 (1897), No. 822, p. 425*).—A note on pond and ditch cleanings as a top-dressing for pastures and how to apply them.

Analyses of commercial fertilizers (*South Carolina Sta. Bul. 29, pp. 30*).—Notes on valuation and on sampling, regulations regarding the sale of commercial fertilizers in South Carolina, and tabulated analyses and valuations of 272 samples of fertilizing materials, including mixed fertilizers, cotton-seed meal, and kainit.

Fertilizer analyses, B. H. HITE (*West Virginia Sta. Bul 46, pp. 408-432*).—The text of the State fertilizer law, notes on valuation, and tabulated analyses and valuations of 480 samples of fertilizers.

FIELD CROPS.

The composition and yield of different varieties of sugar cane, P. BONAME (*Rap. An. Sta. Agron. [Mauritius], 1896, pp. 16-33*).—Experiments were carried on with 61 varieties of sugar cane. The total yields and the sugar content of each variety on August 5, September 8, and October 6 are here reported. Sandal, New Caledonian, and Stripped Java, in the order given, produced the largest amount of sugar per acre, while Setters, Tamarin, and Vilain contained the highest percentage of sugar—23.78, 23.06, and 22.98 per cent respectively, with 94.4, 93.3, and 91.1 as the corresponding coefficients of purity. The early maturing varieties showed but little variation in their sugar content from August to October as compared with the later ripening kinds, which continue to increase their sugar content until the time of the harvest.

Experiments in breeding Noë summer wheat and Göttingen oats, LIEBSCHER, EDLER, and VON SEELHORST (*Jour. Landw., 45 (1897), No. 3-4, pp. 241-263*).—Pot experiments were made to determine the influence of selection of seed. Each experiment occupied 12 pots, only 3 of which received no fertilizer, the rest receiving equal amounts of chemical manures. Three of the pots containing the fertilized soil contained 8 plants each and 6 1 plant each, while in each of the 3 with the unfertilized soil 8 plants were grown. The results are given in detail in tabular form.

The results in the wheat experiments indicate that seed from large heads, so selected for a number of years, produces a greater total yield than seed similarly selected from small heads. The thickness and length of the straw and the length of the upper internode were found to be greater in the plants grown from seed taken from large heads, and the number of internodes was also somewhat greater. Seed taken from heavy-culmed plants produced a heavier, stronger, and somewhat longer straw than seed taken from thin-culmed plants. The number of nodes was also found to be hereditary. The progeny of 5-noded plants produced a larger total crop, stronger and longer culms, and longer heads, than the progeny of 4-noded ones. The upper and fourth internodes were also longer and the heads heavier.

It was further observed that where 1 plant was grown in a pot a smaller yield was obtained than where 8 plants were grown on the fertilized soil and a larger yield than where 8 plants were grown on the unfertilized soil. The plants grown singly had a smaller number of internodes than the other plants. The authors conclude from this that growth in a well-lighted position favors the strengthening of the culm and reduces the number of internodes. The length of the upper internode was found to increase with the increase of strength in the culm and a decrease in the number of internodes, while with the lower internode the opposite took place. The length and the weight of the heads are considered to be dependent on vegetative conditions.

The experiments with Göttingen oats indicated that in general the number of internodes, the weight of the grain, and the number of grains in the head are not transmitted to the progeny. The 8 plants grown in the pot with fertilized soil gave the largest total yield, followed by the single plants and the 8 plants grown on unfertilized soil in the order mentioned. The panicle produced by the single plant was heavier than the panicles of the 8 plants grown in one pot, and the panicles produced on the fertilized soil were heavier than those grown on the unfertilized soil.

Wheat (*Kentucky Sta. Bul. 69, pp. 79–96, pls. 3*).—A test of 17 varieties of wheat was made. The meteorological conditions of the season and the results obtained from the variety tests are given in tables. Bearded Winter Fife heads the list in productiveness, having yielded 30.5 bu. per acre, and proves to be one of the heaviest, a bushel weighing 63 lbs. The variety is also considered worthy of special attention on account of its milling quality. Besides this variety, Oatka Chief, Pedigreed Early Genessee Giant, Early Arcadian, and White Golden Cross yielded more than 25 bu. per acre. Early White Leader, Jones Bearded, and Diamond Grit are not considered good for milling purposes.

A synopsis and detailed description are given of each variety by the botanist of the station. A representative head of each variety is figured and directions given for treating wheat with hot water and bluestone solutions as remedies for smut.

Influence of the nature of soil on the culture of wheat (*Rev. Sci.* [*Paris*], *4. ser., 8* (*1897*), *No. 16, p. 504*).—Conclusions based upon the results of experiments are given. For best yields on humus soils seed grown on argillaceous soils is advised to be used, while on sandy lands seed from a calcareous region, and on calcareous or argillaceous soil seed from a sandy soil is recommended. It is stated that the smallest yields are obtained on humus soils from seed taken from a humus or a calcareous soil; on sandy lands from seed grown on land of the same texture or on a humus soil, and on calcareous soils from seed obtained from calcareous or humus lands.

Experiments with chemical manures, J. R. BOVELL and J. P. D'ALBUQUERQUE (*Rpt. Expt. Fields Dodd's Reform. [Barbados], 1896, pp. 2-30*).—This is a comparison of varieties of sugar cane and a study of the influence of chemical fertilizers on the yield and the chemical composition of the crop. Similar work has been reported in former publications (E. S. R., 8, p. 394). The previous history of the field and the mechanical and chemical analyses of the soils are given. All results are in tabular form. The authors summarize the results obtained in one of the fields as follows:

"The addition of readily available nitrogen to mineral manures produced a large increase in the weight of canes and in the yield of available sugar in the juice; the most advantageous amount being sulphate of ammonia 60 lbs. per acre of nitrogen; a larger application was followed by a marked diminution of yield.

"That the application of nitrogen in the form of such slowly decomposing organic matter as dried blood, added to mineral manures, produced a large increase in the weight of canes and yield of available sugar in the juice, and that such application of organic nitrogen (up to the equivalent of 60 lbs. nitrogen per acre) was applied with greatest advantage during the earlier stages of cane growth.

"That nitrogen in the form of sulphate of ammonia was superior as a source of nitrogen to nitrate of soda.

"The yield of available sugar was increased by the addition of 100 lbs. phosphate per acre in the form of finely ground basic slag carefully applied during the early stage of the canes' growth. The application of superphosphate led to diminished yields, probably due to the poverty of this soil in carbonate of lime.

"The addition of sulphate of potash to manuring of nitrogen and phosphates produced large increase in the yield of cane and of available sugar in the juice per acre.

"An application of sulphate of potash at the rate of 60 lbs. potash per acre applied during the early stage of cane growth produced the best result."

Lime and liming, H. J. WHEELER (*Rhode Island Sta. Bul. 46, pp. 85-109*).—This bulletin reports the results of experiments conducted at the station during the last 4 years to ascertain the effects of liming upon the growth of various plants, including field, garden, and forage crops. The recent experiences of practical farmers who used lime as a fertilizer and soil improver are given, and the chemical and physical effects of lime when applied to the soil are discussed. The different forms of lime for fertilizing purposes are noted, and methods for their application recommended.

The author recommends the application of lime to be made in the field by sowing the lime after plowing and then thoroughly incorporating it into the surface soil by means of a harrow. It is regarded best not to lime just before growing a crop of corn, rye, or millet, as lime when first applied is usually more or less caustic, and in this state is liable to injure the crops, especially when the soil conditions induce rapid nitrification of the soil nitrogen or the nitrogen applied in natural and artificial manures. "If the soil is very sour and nitrates are not employed, then the use of lime immediately before these crops may prove of great service. . . . Under all circumstances lime should be harrowed in immediately or it is liable to cake with the soil and will not yield the best results." It has been found that for vegetables lime may be applied to great advantage in the spring.

The quantity of lime to be applied on light, dry, sandy soils is given as ½ to 1½ tons per acre, and on heavier soils as 1 to 3 tons. One application during a rotation lasting from 5 to 7 years is considered adequate.

Liming experiments with clover and grasses, conducted in different parts of the State, resulted in a marked benefit to these crops.

In 124 instances during the 4 years the experiments were made at the station limed soil was more productive, and in 33 cases less productive, than unlimed land.

In a calculation the author shows that the plant food in wood ashes at $11 per ton is more expensive than plant food in the form of lime and chemicals.

Attention is called to the fact that lime favors the growth of the potato-scab fungus, and a description of the corrosive sublimate and formalin treatments against this disease is given.

Effects of the rotation of crops upon humus content and the fertility of soils, H. SNYDER (*Minnesota Sta. Bul. 53, pp. 1–11*).—A field which had produced small grain for about 40 years was divided into 6 plats of quite uniform fertility and studied for 4 years.

The cropping during the 4 years was as follows:

Plat 1, wheat continuously.
Plat 2, wheat in 1893, clover in 1894, wheat in 1895, and oats in 1896.
Plat 3, oats in 1893, clover in 1894, barley in 1895, and corn in 1896.
Plat 4, corn continuously.
Plat 5, oats continuously.
Plat 6, barley continuously.

The different crops were sampled and analyzed and analyses were made of the upper 9 in. of the soil before and after the experiment. Only 2 plats received humus-forming materials (manure and clover).

At the beginning of the experiment the soil of plat 1 contained 0.221 per cent of nitrogen and after 4 years of continuous wheat growing 0.193 per cent, or a decrease of 0.028 per cent, amounting to an annual loss of 171 lbs. of nitrogen per acre. During the 4 years 98 lbs. of nitrogen per acre were removed in the crop, showing that each year about 146 lbs. of nitrogen were lost from the soil above the amount removed in the crop. "This nitrogen was lost by the oxidation of the humus, by denitrification, mechanically, by wind storms, and through the loss of nitrates by drainage." The author refers to previous work of the station (E. S. R., 5, p. 867) showing that wheat takes over 85 per cent of its nitrogen from the soil during the first 50 days of growth. "Inasmuch as there is only this short period of 50 days when the nitrogen is mainly utilized by the wheat crop, while the breaking down of the humus goes on during 7 or 8 months of the year, it is easy to understand why there is such a heavy loss of nitrogen when a grain crop is raised continuously as on this plat."

In plat 2, where clover was grown in rotation and its second crop plowed under for green manure, the soil originally contained 0.221 per cent of nitrogen and at the end of the rotation 0.231 per cent. Larger crops were grown on this plat than on plat 1, and 178 lbs. of nitrogen was removed in the crops, yet there was a gain of 245 lbs. of nitrogen during the 4 years, in addition to the amount removed. "This nitrogen, it is believed, has been gained largely by the clover from the free nitrogen of the air. . . . The value of a good rotation is exemplified in this experiment where the yields per acre have been increased, and at the same time both the humus and the nitrogen have been increased."

On plat 3 the clover was seeded with oats instead of with wheat as on plat 2. The clover crop, which was rather light, was followed by barley. After the barley crop, this plat received 1,200 lbs. of manure and the next year was seeded to corn, yielding 17 bu. per acre more than plat 4 where corn was grown continuously.

The soil of plat 4 originally contained 0.211 per cent of nitrogen and, after the 4 corn crops were grown 0.197 per cent, amounting to a loss of 340 lbs. of nitrogen. In the 4 crops 225 lbs. of nitrogen were removed, or nearly 29 lbs. more nitrogen was lost from the soil each year than were removed in the crop.

During 4 years of continuous oat growing on plat 5 there was an annual loss of 196 lbs. of nitrogen per acre, of which only about 46 lbs. per acre were removed by the crop. The author states that the yield has been less affected, although this plat lost its nitrogen more rapidly than plat 1, because the oat plant is a stronger feeding plant than wheat.

On plat 6 the soil contained 0.211 per cent of nitrogen, and after 4 years of continuous barley culture 0.177 per cent, showing a total loss of 800 lbs. of nitrogen. It is reported that about 30 lbs. of nitrogen were annually removed by the crop, and that there was an annual loss of 190 lbs. of nitrogen per acre in addition.

It is stated that before the rotations there was an average of about 3.30 per cent of humus and 7.68 per cent of total volatile matter in the soil. The percentages of humus and volatile matter at the close of the rotation periods are given in the following table:

Loss and gain of humus.

	Humus.	Gain (+) or loss (—).	Total volatile matter.	Gain (+) or loss (—).
	Per cent.		*Per cent.*	
Plat I. Wheat continuously	3.00	—0.30	7.48	—0.20
Plat II. Rotation	3.80	+ .50	8.05	+ .37
Plat III. Rotation	3.50	+ .20	7.83	+ .15
Plat IV. Corn continuously	3.10	— .20	7.26	— .42
Plat V. Oats continuously	3.08	— .22	7.04	— .54
Plat VI. Barley continuously	3.10	— .20	6.87	— .81

With continuous wheat raising an annual loss of 1,800 lbs. of humus per acre, and with the continuous culture of corn, oats, and barley, an annual loss of 1,500 lbs. per acre is reported.

The loss of humus affected the physical qualities of the soil, especially the color and the weight. The soils from plats 2 and 3 were darker than those from the other plats and lost in weight while the other soils became heavier.

A strip of land was summer fallowed for 2 years. Before the summer fallowing the soil contained 0.221 per cent of nitrogen and after 2 years 0.201 per cent. The author states that in summer fallowing too much of the nitrogen is changed to available forms and then, as the following crop can not use it all, a large percentage is lost. "While a loss of 0.02 per cent of nitrogen does not appear to be a heavy one, it is in the aggregate quite large, as it amounts to 590 lbs. of nitrogen per acre. Two wheat crops would have removed less than 100 lbs. of nitrogen."

Our grains and field flowers, B. PLÜSS (*Unsere Getreidearten und Feldblumen. Freiburg i. B.: Herder, 1897, pp. 204, figs. 200*).—A description of the grains, the most important forage plants, and the flowers commonly occurring in fields and meadows.

Field trials with artificial fertilizers, K. HANSEN (*Landmansblade, 30 (1897), Nos. 24, pp. 322–327; 25, pp. 340–342*).

Cereal plants: Rye, mixed grain, barley, oats, buckwheat, millet, panicum, and maize, G. HEUZÉ (*Les plantes céréales. II Seigle, meteil, orge, avoine, sarrasin, millet, panis et mais. Paris: Maison Rustique, 1897, 2. ed., pp. 376, figs. 84*).

The essential properties of good malting barley, P. BOLIN (*Landmannen, 8 (1897), No. 38, pp. 534–538*).

Cañaigre (*U. S. Dept. Agr., Office of Experiment Stations Circ. 25, pp. 4, fig. 1*).—This is a revision of Circular 25. A description of the plant is given, with notes on its tannin content and directions for its culture and preparation for market. The States in which it is grown are mentioned and its industrial importance pointed out.

Broom corn (*U. S. Dept. Agr., Office of Experiment Stations Circ. 28, pp. 4*).—This is a revision of Circular 28 (E. S. R., 9, p. 241). The varieties of broom corn; the climate, soil, and manuring requisite for its successful culture; and its feeding value are discussed; and directions are given for planting, cultivating, harvesting, and curing.

Flax, its culture and use, with suggestions for the improvement of the industry, R. KUHNERT (*Der Flachs, seine Kultur u. Verarbeitung, nebst Vorschlägen zur Hebung des Flachsbaues. Berlin: Paul Parey, 1897, pp. 198, figs. 40*).

Pasture and pasture plants, W. TOOGOOD (*New York: The Macmillan Co.; London: Macmillan & Co. Ltd., 1897, pp. 72, figs. 35*).—In the compilation of this treatise the chief aim of the author has been to concisely summarize his own experiences in pasture-making, but the recorded experiences of great authorities on the subject have also been consulted and form, to some extent, the basis of the work. The book contains 9 chapters in which cultural preparations, selection of pasture plants, buying, testing, and sowing of pasture seeds, and the care of new and of established pastures are discussed, and 20 varieties of grasses and 9 varieties of legumes useful as pasture plants are described.

The renewing of worn-out native prairie pastures, T. A. WILLIAMS (*U. S. Dept. Agr., Division of Agrostology Circ. 4, pp. 4, figs. 4*).—A revision of Circular 4 (E. S. R., 8, p. 774).

Comparative experiments with 190 varieties of potatoes to determine the starch production, at the agricultural-botanical experiment station at Tabor [Bohemia] in 1896, F. SITENSKÝ (*Časopis pro Průmysl Chemický, 7 (1897), pp. 233, 279; abs. in Chem. Ztg., 21 (1897), No. 95, Repert., p. 289*).—According to the brief abstract, the starch content varied from 9.6 to 19 per cent, and the yield of starch per hectare from 1,282 to 6,386 kg. (1,141 to 5,684 lbs. per acre).

Culture tests with new varieties of potatoes (*Tidskr. Landtmän, 18 (1897), No. 12, pp. 204–209*).—Trials with 36 varieties of potatoes containing from 14.1 to 24.6 per cent of starch, and yielding 9,820 to 26,420 kg. of tubers per hectare, and 2,268 to 6,003 kg. of starch.

Potash fertilizers for root crops and barley, H. NATHORST (*Tidskr. Landtmän, 18 (1897), No. 6, pp. 91–95*).

Sugar beet culture, S. FORSBERG (*Tidskr. Landtmän, 18 (1897), No. 9, pp. 153–157*).

The influence of the distance between plants on the yield and sugar content of sugar beets, F. DESPREZ (*Jour. Agr. Prat., 2 (1897), No. 48, pp. 816–819*).—A number of plats were planted with beets at the rate of 16.6, 12.5, 10, and 8.3 plants per square meter. The largest amount of sugar per hectare was obtained from the closest planting.

The state of cane sugar manufacture in Formosa, N. YAMASAKI (*Imp. Univ. Col. Agr. [Tokyo] Bul., vol. 3, No. 3, pp. 275–280*).—A description of the industry as it is carried on in the island.

Silage making according to the Rahmstedt method (*Landtmannen, 8 (1897), No. 38, pp. 540–542*).

Tobacco from the seed bed to the packing case: The result of three years' experience in southern California with plain practical directions for the grower on the Pacific Coast, Arizona, and New Mexico, W. T. SIM (*Los Angeles: Stoll, Thayer & Co., 1897, pp. 26*).

Report of the assistant in dairy husbandry, C. B. LANE (*New Jersey Stas. Rpt. 1896, pp. 171–181, pl. 1*).—This is a brief description of the college farm; the yield and cost of rye, wheat, crimson clover, oats and peas, corn, cowpeas, soy beans, and barley and peas grown as silage crops; a description and record of the dairy herd; methods of seeding crimson clover; and a description of an experimental silo.

Marsh culture, and the manufacture of peat litter and peat fuel in Sweden, Denmark, and Germany, H. U. SVERDRUP (*Aarsber. Offent. Foranst. Landbr. Fremme, 196, pp. 342–391*).

HORTICULTURE.

Some problems in experimental horticulture, W. M. MUNSON (*Vermont Hort. Soc. Rpt. 1896, pp. 32–40*).—The author believes that, while it is the first duty of an experiment station to adapt its work to the specific needs of the region in which it is located, the working out of fundamental principles should not be ignored. A certain amount of variety testing, for instance, is of value, but it should not be made the chief work of the station. One of the most important lines of work, the author believes, is plant breeding, and in this work a very important thing is to determine the causes of variation in plants and how generally variations are transmitted to offspring. In crossing and hybridizing the aim should be to study the laws governing hybrids as well as to produce new types of immediate value. The pedigree should be given more weight in plant breeding than it has yet been given. As corollaries to plant breeding, acclimatization, domestication, etc., are discussed.

Among the practical problems of experimental horticulture, the author suggests the treatment of orchard and small fruits with reference to culture, pruning, food, winter protection, etc.; the merits of various stocks for grafting certain varieties; the origin and development of new varieties of fruits and vegetables; the questions relating to forcing fruits and vegetables; and the like. Vegetables and ornamental gardening are mentioned as affording valuable lines of work.

Depth of sowing and planting, B. D. HALSTED (*New Jersey Stas. Rpt. 1896, pp. 395, 396*).—Beet seed covered 4 to 6 in. failed to germinate. There was little difference in results from seed planted 2 in. and 1 in. deep. With beans about one-half as many seed germinated in the 6 in. planting and about two-thirds as many in the 4 in. planting as in the 1 in. planting. Beans, when planted 4 and 6 in. deep and the drills filled gradually as the plants developed, germinated as well as those planted at the ordinary depth, and the yield was practically the same in all cases. With potatoes planted 4, 6, and 8 in. deep, the 6 in. planting gave the largest yield, also the greatest percentage of scab, while the 4 in. planting gave the smallest yield and percentage of scab.

Experiments with mulching, B. D. HALSTED (*New Jersey Stas. Rpt. 1896, pp. 393–395*).—Mulchings of fresh hay, salt hay, and excelsior were employed with several vegetables. There was no appreciable difference in yield of peppers, eggplants, cucumbers, tomatoes, beets, and second crop of beans between the mulched and unmulched rows. The mulched rows of the first crop of beans gave a somewhat larger yield than the unmulched. The difference between the results here reported and those of 1895 (E. S. R., 8, p. 886) the author believes to be due to the greater rainfall in 1896. Salt hay was found better for mulching than either of the other materials tried.

Irrigation of garden crops, B. D. HALSTED (*New Jersey Stas. Rpt. 1896, pp. 338–383*).—This is a continuation of the experiment reported in Bulletin 115 of the station (E. S. R., 8, p. 127), a summary of which is given in this report. The quantities of water applied to the various crops and the dates of the applications are shown in tables. With a majority of the crops irrigation in a season of normal rainfall was found to be unprofitable.

The yield of the first crop of peas was increased nearly 30 per cent and the weight of the vines doubled by irrigation. In the second crop the weight of the vines on the irrigated plat was somewhat less than on the others. Few pods developed in either case on account of blight. Tomatoes yielded less, the fruit was more spotted and more cracked in the irrigated than in the unirrigated plats. As to the prevalence of leaf blight, little difference could be seen between the irrigated and the unirrigated plats.

Irrigation had little effect on the yield of beans, peppers, cucumbers, beets, turnips, and eggplants; on the amount of scab and blight of beets; and on the amount of leaf blight and fruit rot of eggplants. The proportion of turnips affected with club root was about the same in the two cases, but the affected roots were somewhat more severely injured on the irrigated than on the unirrigated plats. The amount of bacterial blight of beans was somewhat greater in the case of the unirrigated than of the irrigated plants.

In the experiment with Rural No. 2, American Giant, and Early

Rose potatoes, the yield was 9 per cent greater and the amount of scab slightly less on the irrigated plants than on the unirrigated ones. In another test, irrigation did not appreciably affect the yield or percentage of scab of Rural No. 2 potatoes. With American Giant potatoes, the yield and amount of scab was greater on the irrigated plats than elsewhere. The yield of Early Rose potatoes was considerably greater and the scabbiness from 19 to 27 per cent less on irrigated than on unirrigated plats. A test of both surface and subirrigation with Early Rose patatoes resulted in no difference in yield and very little difference in scabbiness between the irrigated and the unirrigated plants.

Studies and illustrations of mushrooms, I, G. F. ATKINSON (*New York Cornell Sta. Bul. 138, pp. 337–366, figs. 26*).—This is the beginning of a proposed series of bulletins on the fleshy fungi of the mushroom family. The author briefly discusses the need of a more general knowledge of the more common mushrooms in order that the nutritious ones may be used and the poisonous ones avoided. He believes that many common forms of mushrooms may be learned by people without a technical knowledge of the subject, just as many other natural objects are known.

Popular descriptions and illustrations are given of *Agaricus campestris*, *Lepiota naucina*, and *Amanita phalloides*, showing the peculiarities of the plants at various stages of growth. The life history of mushrooms is also given in a popular way.

Turnips, F. S. EARLE (*Alabama College Sta. Bul. 84, pp. 415–420*).—Directions for planting and culture and a note on the uses of turnips are given. About 40 varieties of turnips, many of them foreign, were tested at the station. The foreign varieties were found to be no better than varieties commonly grown in this country. The flat varieties of turnips are valuable for early crops and marketing when young. The long varieties have nothing in particular to recommend them. The Globe varieties are best for the main crop and for fall and winter use. For late winter the Yellow Globes are especially recommended. The flat and the long varieties, on account of much of their roots being exposed, are often rendered unfit for use by being frozen. The Globe varieties have a deep rooting habit and therefore are least injured by freezing.

Notes on the cherry orchard, W. B. ALWOOD (*Virginia Sta. Bul. 65, pp. 69–74*).—Notes are given on 22 varieties of cherries, together with a table showing the dates of bloom of each for the years 1893–'97. The following varieties are thought worthy of general culture for market and family use: Early Purple, Schmidt, Windsor, Hortense, Olivett, and Montmorency Large.

In a situation so exposed to late spring frosts that peaches can not be grown, that Japanese plums can not fruit, and that apples fruit only once in 2 or 3 years, the Hearts, or sweet cherries, as a class have failed to fruit, although the trees have proved hardy in many cases. Both Hearts and Morillos are more readily grown than peaches in situations where the latter succeed.

Notes on the plum orchard, W. B. ALWOOD (*Virginia Sta. Bul. 67, pp. 93–97*).—Tabular data in regard to dates of blossoming of 37 varieties of plums for the years 1893–'97 are given, together with notes on growth, fruitfulness, etc. The Japanese varieties have proved somewhat erratic as to time of blossoming, being stimulated into unseasonable bloom by a few warm days. As a preventive of brown rot, the author recommends removing all decayed fruit from the tree as soon as the leaves have fallen, and spraying in the spring before the buds start with a solution of concentrated lye, 8 cans to 50 gal. water, or with a solution of copper sulphate, 2 lbs. to 50 gal. water, the lye solution being preferred, and spraying twice with a weak Bordeaux mixture just before the flower buds open and again when the blossoms have fallen.

Japanese plums, F. S. EARLE (*Alabama College Sta. Bul. 85, pp. 423–448, figs. 5*).—The bulletin is a popular discussion of the culture of the Japanese plums, including notes on soil, fertilizers, propagation, planting, cultivation, pruning, thinning, marketing, insect enemies, diseases, and varieties. The author believes that the Japanese plums are destined to supersede the native plums in Alabama. Tendency to overbear is considered their greatest fault, the fruits often setting so thick as to hide the limb from view. Thinning the fruit is therefore strongly recommended. It increases the size of the fruit, lessens the injury from rot, and prevents the loss of vitality of the tree. An illustration is given of two twigs of Burbank plum, showing the increased size of fruit due to thinning.

The most reliable remedy for the plum curculio is jarring the tree. Descriptions are given of two modifications of the "curculio catcher" for low-headed trees. Trapping the beetles under pieces of bark placed around the trees, destroying all fallen, wormy fruit, and spraying the trees with Paris green are also recommended.

Plum rot is the most troublesome disease of plums. The remedies recommended are planting resistant varieties, selection of high, well-drained soil of moderate fertility, use of only such fertilizers as will not induce a rapid, succulent growth of wood, training the trees with open heads to allow free circulation of air, thinning the fruit, burning dead twigs and mummified fruits in winter, and spraying with Bordeaux mixture in spring and with copper acetate after the fruit is formed.

Strawberry culture, S. POWERS (*Florida Sta. Bul. 39, pp. 465–504*).—This is a popular bulletin giving directions for growing and marketing strawberries. A good quality of flat-woods soil, overlying a clay subsoil and having a gradual slope to the south, is recommended. Light sandy soils are to be avoided except where an abundance of water is available. The plants grow practically all winter, and should therefore be allowed to rest during midsummer, no cultivation being given them.

The author believes that the deterioration of strawberries in Florida is due to careless methods of propagation and cultivation more than to the climate. To get new vitality, plants may be brought from the foothills of Alabama or Georgia. Plants brought from States north of the Potomac and Ohio rivers do not succeed in Florida.

Notes are given on the diseases and insect enemies of the strawberry. A brief paper by C. H. Ward is added to the bulletin.

Catalogue of fruits recommended for cultivation in the various sections of the United States by the American Pomological Society (*U. S. Dept. Agr., Division of Pomology Bul. 6, pp. 39*).—The catalogue includes such fruits and nuts as are recommended for culture in the United States and adjoining parts of British America. The entire region is divided into 15 fruit districts, the limits of districts being determined largely by latitude, elevation, prevailing winds, oceanic and lacustrine exposures, and very little by political boundaries.

For convenience in reference the fruits are arranged alphabetically in 3 divisions. The first division deals with fruits adapted to the middle and northern United States and adjacent parts of British America, and includes 277 varieties of apples, 12 apricots, 20 blackberries and dewberries, 41 cherries, 20 currants, 14 gooseberries, 88 grapes, 4 mulberries, 94 nectarines and peaches, 95 pears, 90 plums, 8 quinces, 48 raspberries, 35 strawberries, and 69 nuts. The second division has to do with fruits adapted to southern United States and includes 104 varieties of citrus fruits, 11 figs, 7 guavas, 11 Japanese persimmons, 28 olives, 18 pineapples, and 5 pomegranates. In both these divisions descriptions of each fruit recommended and the adaptability of each to the various fruit districts are given in tabular form.

The third division treats of such species of native and introduced fruits and nuts as have not varied so far from their specific types that the varieties have been designated and propagated under recognized varietal names. The botanical and common names, origin, and adaptability of 145 species of fruits, and 30 species of nuts are given in tabular form.

The bulletin also contains the rules of the American Pomological Society for naming and exhibiting fruits.

Experience in fertilizing potted plants with Wagner's solution, W. E. BRITTON (*Gard. and Forest, 10 (1897), No. 508, p. 456*).—The effect of a liquid fertilizer on various potted plants was tested at Connecticut State Station. The fertilizer consisted of a solution of 30 gm. ammonium phosphate, 25 gm. sodium nitrate, 25 gm. potassium nitrate, and 20 gm. ammonium sulphate in 100 liters of water. One lot of plants, 2 each of begonias and pelargoniums and 4 of heliotrope, was potted in rich soil, 3 parts turf and 1 part manure, and watered with clear water. Another similar lot was potted in the same soil and watered with the liquid fertilizer noted above. A third lot of plants was potted in anthracite coal ashes, to which was added 5 per cent of moss peat, and watered with the fertilizer solution. In a few months the plants were repotted. Their growth was greatest in the rich soil watered with the fertilizer solution. The root development was very good in the rich soil given clear water, much smaller in the rich soil given the liquid fertilizer, and very small in the ashes and peat. About a month later, some of the pelargoniums given the liquid fertilizer wilted even while the soil was saturated with moisture. The plants were apparently very thrifty until they began to wilt. The author believes that "the amount of easily available nutritive matter in the soil exercises a considerable influence upon the size of the root system." Further work showed that the use of the solution gave excellent results when applied less frequently, once a week for woody plants and twice a week for rapid growing, herbaceous ones.

The camphor tree, L. H. DEWEY (*U. S. Dept. Agr., Division of Botany Circ. 12, pp. 7, figs. 2*).—A description is given of the camphor tree and the following points in regard to it are noted: Native range; range under cultivation; uses; conditions of successful cultivation; methods of propagation, planting, and cultivation; distillation of camphor; outlook for future market, etc.

Fertilization of house plants, C. ENGELSKJÖN (*Om vore Potteplanters Gjödsling. Christiania, 1897, pp. 42*).

Practical handbook of asparagus culture, J. BÖTTNER (*Praktishes lehrbuch des spargelbaus. Frankfurt a. Oder: Trowitzsch u. Sohn, 1897, pp. 100, figs. 40*).—This treats of planting, manuring, harvesting, forcing, varieties, diseases, and insect enemies of asparagus.

How to grow melons for market, W. A. BURPEE (*Philadelphia: W. Atlee Burpee & Co., 1897, 8. ed., pp. 81, figs. 25*).—The book is a compilation of three prize essays, to which the experience of the editor is added. Details of growing and marketing muskmelons and watermelons and lists of approved varieties are given.

Observations on recent cases of mushroom poisoning in the District of Columbia, F. V. COVILLE (*U. S. Dept. Agr., Division of Botany Circ. 13, pp. 21, figs. 21*).—The circular notes recent cases of mushroom poisoning and urges greater caution in the selection of mushrooms for table use. Illustrations and popular descriptions of a number of mushrooms occurring commonly in the District of Columbia are given, including 5 edible species—the common mushroom (*Agaricus campestris*), the horse mushroom (*A. arvensis*), the shaggy mushroom (*Coprinus comatus*), the puff ball (*Licoperdon cyathiforme*), and the fairy ring mushroom (*Marasmius oreades*); and 2 poisonous species, the fly amanita (*Amanita muscaria*) and the death cup (*A. phalloides*).

Report of the assistant in horticulture, J. T. JORDAN (*New Jersey Stas. Rpt. 1896, pp. 160–169*).—An outline of the horticultural work in progress at the station is given. A detailed account is given of the treatment of the various experimental plats of fruits and vegetables.

Improved breeding in plant and animal life, A. G. LUCAS (*Trans. Iowa State Hort. Soc., 31 (1896), pp. 177–183*).—The author discusses some analogies of plant and animal life and believes that the principles of animal breeding may be applied by the horticulturist in the improvement of plants.

Production of new hardy fruits by crossing and hybridizing, J. L. BUDD (*Trans. Iowa State Hort. Soc., 31 (1896), pp. 260–262*).—Notes are given on the facilities for making crosses, the advances already obtained, and the minutiæ of doing the work.

Catalogue of fruits (*Proc. 20th An. Meeting Georgia State Hort. Soc., 1896, pp. 77–94*).—Descriptions and notes of various fruits and indications of their adaptability to various sections of the State of Georgia are given in tabular form. The fruits considered are apples, peaches, nectarines, apricots, pomegranates, pears, plums, grapes, strawberries, raspberries, blackberries, mulberries, cherries, quinces, and figs. Descriptive notes are also given on various varieties of walnuts, pecans, chestnuts, almonds, filberts, Japanese plums, and Japan persimmons.

Handbook of Swedish pomology, O. ENEROTH (*Handbok i svensk Pomologi. New ed., rev. and enl. by A. Smirnoff. Stockholm: Norstedt & Söner, vols. 2*).

Russian apples, J. B. MITCHELL (*Trans. Iowa State Hort. Soc., 31 (1896), pp. 265–269*).—The adaptability of the Russian apples to Iowa is discussed and descriptive notes are given on 56 varieties fruited by the author.

The russets of Maine, Z. A. GILBERT (*Trans. Maine State Pom. Soc., 1896, pp. 76–90, pls. 5*).—Notes on some russet apples, with descriptions of 10 varieties and illustrations of 5.

The garden of citrus fruits, C. MANCINI (*Il giardino d'agrumi. Casale: C. Cassone, 1897, pp. 238*).—A monograph on the cultivation of citrus fruits in Italy.

Notes on peach culture, J. H. HALE (*U. S. Dept. Agr., Division of Pomology Circ. 3, pp. 8, figs. 4*).—This is a revised reprint of an article in the Report of the Pomologist for 1894.

Is the Satsuma plum self-sterile? (*Rural New Yorker, 56 (1897), No. 2492, p. 710*).—A statement from C. E. Clark, Newark, New York, indicates the possible self-sterility of this plum. The orchard contained 25 trees each of 4 varieties of Japanese plums, each variety being in a block unmixed with other varieties. Abundance and Burbank plums set fruit very abundantly, Chabot set less fruit, and Satsuma set very little. The Satsuma trees in the rows next to Burbank and Chabot trees fruited well, those in the second rows fruited less, those in the third rows fruited very little, and those in the corner farthest from the other varieties bore no fruit at all.

Prune culture in the Pacific Northwest, E. R. LAKE (*U. S. Dept. Agr., Division of Pomology Circ. 2, pp. 7, figs. 3*).—A revised reprint of an article in the Report of the Pomologist for 1894.

Currants and gooseberries, W. M. MUNSON (*Trans. Maine State Pom. Soc., 1896, pp. 146–152*).—A popular article which treats of soil, propagation, culture, pruning, and training, varieties, insects, and diseases of currants and gooseberries.

Strawberries, variety tests of 1896, H. N. STARNES (*Proc. 20th An. Meeting Georgia State Hort. Soc., 1896, pp. 25–28*).—A report of a test of 80 varieties of strawberries at the Georgia Station.

Grapes (*Rural New Yorker, 56 (1897), No. 2499, pp. 822, 823*).—A résumé of 20 years' experience with various varieties of grapes at Farmingdale, Illinois.

Nut culture, H. M. ENGLE (*U. S. Dept. Agr., Division of Pomology Circ. 1, pp. 4*).—A reprint of an article in the Report of the Pomologist for 1894.

Carnations at the Cottage Gardens, Queens, New York (*Florists' Exchange, 10 (1898), No. 1, pp. 10, 11*).—Notes on a number of varieties of carnations.

The hardy species of clematis, W. J. BEAN (*Garden, 52, No. 1362, pp. 499–503, figs. 4*).—Descriptive notes on 36 species of clematis.

Crossing chrysanthemums, G. P. RAWSON (*Florists' Exchange, 9 (1897), No. 52, p. 1174*).

Hackberries as ornamental and shade trees, J. SCHNECK (*Meehan's Mo., 7 (1897), No. 12, pp. 231, 232, figs. 4*).—Illustrated notes are given of *Celtis occidentalis* and *C. mississippiensis*.

Lawns and gardens, how to plant and beautify the home lot, the pleasure ground, and garden, N. J. ROSE (*New York and London: G. P. Putnam's Sons, 1897, pp. 414, pl. 1, figs. 172*).—The first part treats of the principles and practices of landscape art with chapters on the following topics: The study of natural scenery, implements, the plan, grading, drives and walks, grouping and massing trees and shrubs, detached groups and specimen plants, the proper use of herbaceous plants, the lawn, rocks and water, flower beds and borders, hedges, buildings, etc. The second part treats of the best hardy ornamental plants for the temperate zone of North America, under the following chapter heads: Deciduous trees, coniferous trees, flowering trees, ornamental shrubs, creepers and vines, and herbaceous plants. The numerous plans and illustrations are prepared by the author.

Experiments with lawn grasses, B. D. HALSTED (*New Jersey Stas. Rpt. 1896, pp. 400, 401, fig. 1*).—A report is given of a limited trial of meadow fescue, five leaved fescue (*Festuca tenuifolia*), sheep's fescue, Rhode Island bent, wood meadow grass, Kentucky blue grass, rough stalked meadow grass, redtop, and rye grass. All plats were treated alike and all seed gave a comparatively good stand except the second and third varieties.

Orchid culture (*Amer. Florist, 13 (1897), No. 499, pp. 521, 522*).

The Horticultural School in Rentglingen and horticulture in southern Germany, H. MISVAER (*Norsk Havetidende, 13 (1897), No. 2, pp. 17–33*).

Europe's largest horticultural school, L. SPÄTH (*Sv. Trädgårdsför. Tidskr., 1897, Nos. 2, pp. 19–24; 3, pp. 40–44*).

FORESTRY.

Age of trees and time of blazing determined by annual rings, B. E. FERNOW (*U. S. Dept. Agr., Division of Forestry Circ. 16, pp. 11, figs. 12*).—The author discusses the growth of trees and the method of deposition of annual rings, and points out some of the sources of error in estimating the age of trees by counting the annual rings.

To find how many years have elapsed since a cut was made it is necessary to have a cross section or part of a cross section of a stem that embraces a radius of the trunk near the wound, then the number of rings may be counted from bark to pith, and the particular ring leading to the edge of the wound may be traced from the wound to the radius along which the counting is done. This method is generally correct to within about half a year, but at times may result in an error of a whole year.

Notes on cultivated conifers, XIII, C. S. SARGENT (*Gard. and Forest, 10 (1897), No. 514, pp. 509–512*).—Notes are given on various species of Abies.

The geographic distribution of deciduous and coniferous trees, GRANER (*Jahresheft. Ver. Naturkunde Württemberg, 53 (1897), pp. 142–179; abs. in Bot. Centbl., 72 (1897), No. 9, pp. 305–308*).

Contributions to the knowledge of North American conifers, E. BASTIN and H. TRIMBLE (*Amer. Jour. Pharm., 69 (1897), No. 7*).—Treats of *Tsuga mertensiana* and *T. caroliniana*.

The old field pine in New Jersey, A. HOLLICK (*Forester, 3 (1897), No. 12, p. 136*).—Notes the occurrence of *Pinus tæda* in New Jersey.

On the southern range of Lawson's cypress, J. B. DAVY (*Erythea, 5 (1897), No. 9, p. 99*).—Notes are given on the southern range of *Chamæcyparis lawsoniana*.

The Shasta fir, F. V. COVILLE (*Gard. and Forest, 10 (1897), No. 514, pp. 516, 517*).—Notes are given on *Abies shastensis* and allied species.

The weeping silver fir, A. D. WEBSTER (*Gard. Chron., 3. ser., 22 (1897), No. 567, p. 324*).

Foreign evergreens adapted to Swedish parks, C. J. ROSSANDER (*K. Landt. Akad. Handl. Tidskr., 36 (1897), No. 3, pp. 144–162*).

Evergreens in Alnarp park (Sweden), F. ULRIKSEN (*K. Landt. Akad. Handl. Tidskr., 36 (1897), No. 3, pp. 163–187*).

Sequoia gigantea, G. MACKINLAY (*Gard. Chron., 3. ser., 22 (1897), No. 570, p. 379, fig. 1*).—Illustrated notes are given of a sequoia tree that has been planted for 51 years in a park. The height of the tree at the time of writing was 74 ft. 3 in. and the circumference at ground level was 21 ft. 3 in.

The fruit of Sequoia, C. S. SARGENT (*Gard. and Forest, 10 (1897), No. 514, p. 514, fig. 1*).—The fruit of *Sequoia wellingtonia*, formerly *S. gigantea*, ripens in 2 years, while that of *S. sempervirens* ripens in 1 year.

The weeping spruce (*Gard. Chron., 3. ser., 22 (1897), No. 569, p. 368, fig. 1*).—Figures and describes a rather remarkable form of *Picea excelsa*.

Planting and thinning spruce woods (*Gard. Chron., 3. ser., 22 (1897), No. 569, p. 360*).

The willow oak, H. TRIMBLE (*Amer. Jour. Pharm., 69 (1897), No. 12, pp. 617–619*).

Recent investigations on forest injuries due to rust fungi, H. KLEBAHN (*Forstl. Naturw. Ztschr., 6 (1897), No. 12, pp. 465–473*).

Recent legislation on State forestry commissions and forest reserves, B. E. FERNOW (*U. S. Dept. Agr., Division of Forestry Circ. 17, pp. 15*).—Several States and Territories having enacted forest legislation since the publication of Circular 13 of this Division, the author has given a summary of the recently enacted laws of New York, Pennsylvania, Wisconsin, and Minnesota and the Federal legislation relating to the establishment of forest reservations.

SEEDS—WEEDS.

The vitality of seed treated with carbon bisulphid, G. H. HICKS and J. C. DABNEY (*U. S. Dept. Agr., Division of Botany Circ. 11, pp. 5*).—The authors report upon a series of experiments conducted to test the effect of carbon bisulphid when used for the destruction of weevils and other insects in stored grain. Experiments were made on 35 varieties of grain and vegetables, 5 of cotton, 2 of peas, 3 of corn, 2 each of rice, garden beans, Kafir corn, barley, and wheat. The first series of experiments were conducted by placing the seed in an atmosphere saturated with carbon bisulphid. The seeds were allowed to remain for 48 hours, after which their germination was tested. The germinative ability of barley, rye, wheat, corn, crimson clover, millet, and rice was considerably decreased by the treatment. The others were practically uninjured. Other experiments were conducted in which the seed were treated for 24 hours and a limited experiment was conducted with grain in bulk.

In general it is stated that seeds of cotton, peas, beans, buckwheat, oats, cowpeas, and various members of the crucifers will withstand the most severe treatment without having their germination injured to any appreciable extent. On the other hand, corn, wheat, rye, and other seeds belonging to the grass family, with the exception of Kafir corn and oats, should be treated with caution, as excessive exposure to the gas seriously diminishes their vitality.

On the germination of weeviled leguminous seed, E. GAIN (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 3, pp. 195–197*).—A report is made of more than 3,000 germinations, embracing seed of 31 species of leguminous plants, in which the author found considerable injury is done by the attack of the weevil. This injury is due to the following causes: (1) Destruction of part of the embryonic reserve; (2) mutilation of regenerative parts; (3) exosmosis, through which a very considerable quantity of the nutritive material in the seed is lost, and (4) the biological and mechanical action of the parasite. The injury due to the latter cause is not limited in its effect to the seed alone, but may be transmitted to the plant, resulting in a deteriorated growth.

Three new weeds of the mustard family, L. H. DEWEY (*U. S. Dept. Agr., Division of Botany Circ. 10, pp. 6, figs. 3.*)—Illustrated descriptive notes are given on 3 new plants of the mustard family which have been reported from several localities in northern United States and Canada during the past few years. Although confined to comparatively small areas and having thus far caused little damage, in some places they are becoming very aggressive weeds. The species enumerated are *Berteroa incana*, the hare's ear mustard (*Conringia orientalis*), and ball mustard (*Neslia paniculata*).

Testing seeds, C. D. WOODS (*Maine Sta. Bul. 36, pp. 8*).—This bulletin contains "An act to regulate the sale of agricultural seeds," enacted by the Maine legislature, and rules for testing the purity of seeds taken from those adopted by the Association of American Agricultural Colleges and Experiment Stations, but modified to conform to the requirements of the law of the State. Standards of purity and germination of agricultural seeds are given in a table.

Concerning the germination of Fraxinus, G. F. L. SARAUW (*Tidsskr. Skov., 6, pp. 62–70*).

Concerning the longevity of seeds and their preservation in the soil, NAUDIN (*Bul. Soc. Nat. Acclim. France, 1897, Feb.–June*).

The vitality of refrigerated seeds, H. T. BROWN (*Nature, 57, No. 1468, p. 150*).—Calls attention to the work of Giglioli on latent vitality of seeds (E. S. R., 7, p. 406).

Concerning the composition of the seed and etiolated seedlings of Lupinus angustifolius, M. MERLIS (*Landw. Vers. Stat., 48 (1897), No. 6, pp. 419–454*).

Work with weeds, B. D. HALSTED (*New Jersey Stas. Rpt. 1896, pp. 402–404, figs. 2*).—A case for examining commercial seed for weed seed and other foreign matter is figured and described. The Russian thistle which was reported from Weehawken last year seems to have been destroyed, no trace of it being reported during the year, nor has it been found elsewhere in the State. The occurrence of dodder upon seedling eggplants grown in a hotbed and upon onions is reported.

Cuscuta monogyna on grapes, A. ROLLOFF (*Ztschr. Pflanzenkrank., 7 (1897), No. 4, p. 213*).—The occurrence of this species of dodder on grapevines is mentioned, and placing finely cut straw thickly about the vines is recommended as a preventive means.

On the eradication of Cuscuta, NOFFRAY (*Jour. Soc. Agr. Brabant-Hainaut, 1897, No. 40*).

Noxious weeds (*Jour. Agr. and Ind., South Australia, 1 (1897), No. 4, pp. 322–324, figs. 2*).—Notes are given of the Canada thistle and of *Xanthium spinosum*.

Effect of Swainsonia galegifolia on sheep, C. T. MARTIN (*Agr. Gaz. New South Wales, 8 (1897), No. 6, pp. 363–369*).

Concerning Lathyrus tuberosus as a grain-field weed, R. SCHÄFFER (*Jahresber. Preus. Bot. Ver., 1896–'97, p. 45*).

Poisonous plants of Germany, F. G. L. GRESSLER (*Langensalza: F. G. L. Gressler, 1897, pp. 40, pls. 8*).

DISEASES OF PLANTS.

Report of the botanist, B. D. HALSTED (*New Jersey Stas. Rpt. 1896, pp. 289–429, figs. 60*).—The work of the botanical department of the station for the year was mostly field experiments at the college farm and elsewhere, supplemented with laboratory investigations. The principal lines of work were with fungicides on various truck crops and on a few kinds of ornamental plants. A study of the peach gall was the principal investigation carried on in the greenhouse. Some horticultural work included in the report is noted elsewhere.

During the year the experimental plat for botanical work was increased to nearly 2 acres. Several hundred specimens were added to the herbarium during the season, and some attention was given to a study of weeds and the determination of foreign matter in commercial seeds.

Experiments with turnips (pp. 294–309).—After summarizing the experiments for the previous four crops the author reports upon the work done in 1896 for the prevention of club root. Of the various fungicides tried unslaked lime has thus far proved to be the only efficient treatment for the prevention of club root of cruciferous plants. It is recommended that it be applied at the rate of from 75 to 150 bu. per acre. This application should be made every other year on land badly infested with the fungus where cabbages, turnips, or allied plants are yearly grown.

Plat experiments indicate that the fungus of club root can remain active in the soil for at least 2 years, and from box experiments in which the soil was considered free from the fungus it was apparent that manure may be the means of carrying the infection to the soil.

The author tested 16 species of cruciferous plants to ascertain their susceptibility to club root. Those so tried were candytuft, sweet alyssum, wild sweet alyssum, shepherd's purse, rockcress, wormseed mustard, peppergrass, field peppergrass, stock, penny cress, radish, rocket, black mustard, charlock, white mustard, and false flax. Of these, stock alone was unaffected, while charlock proved most subject to attacks of the disease, followed closely by white mustard. The necessity of keeping these weeds out of fields is obvious. Radishes, rocket, sweet alyssum, and candytuft were least affected.

Experiments with potatoes (pp. 309–319).—In continuation of the experiments of previous years, reported in Bulletin 112 and the Annual Report of the station for 1895 (E. S. R., 7, p. 780; 8, p. 893), the prevention of potato scab was investigated. The author states that Bordeaux mixture and ammoniacal copper carbonate were efficient to some degree in controlling scab. Sulphur took the lead among the soil treatments, and its effect on the soil is claimed to be lasting. Treating seed with sulphur or corrosive sublimate, while efficient in clean soil, will not avail much in badly infested soil. A mixture of 300 lbs. each of sulphur and kainit per acre is recommended as a combined fungicide and fertilizer for use on scab infested lands.

An opportunity was offered to test the respective value of the bud and stem ends with the middle of the potato when used in planting, also the effect of depth of planting. The superiority of the middle portions over the end cuttings was established, so far as this experiment was concerned. It is claimed that planting more than 4 in. deep is not justified on account of greater labor.

Potatoes planted upon turnip land that had not been planted to potatoes for 6 years gave a larger total yield of tubers, but the crop was practically worthless on account of scab.

Experiments with sweet potatoes (pp. 319–328).—Experiments for the prevention of soil rot of sweet potatoes are reported in continuation of those given in the Annual Report of the station for 1895 (E. S. R., 8, p. 893). Lime, sulphur, manure, corrosive sublimate, kainit, and copper sulphate were tested singly and in different combinations, and as in the previous experiment sulphur gave the best results, followed closely by kainit and copper sulphate and kainit alone.

Additional experiments are reported on the cost and value of sulphur, when given field trials, as a preventive of soil rot.

A brief illustrated description is given of the stem rot of sweet potatoes, but no treatment is suggested.

Experiments with beans (pp. 328–333).—Investigations have been continued on the anthracnose and bacterial disease of beans. Anthracnose was nearly checked by spraying the plants and the occurrence of the bacterial disease was greatly diminished on the sprayed plants.

The author states that experiments with beans to determine the effect of depth of planting indicate that between 1 and 2 in. is probably the best depth for the variety used (Golden Wax).

Experiments with tomatoes (pp. 333–336).—Tomatoes were grown for 3 years on the same soil. The amount of leaf blight (*Septoria lycopersici* and *Cladosporium fulvum*) increased with each succeeding crop, while the fruit rot (*Glœosporium phomoides*) was about the same for each crop. This seems to indicate that there is some connection between the old tomato plants allowed to remain on the ground and the diseased condition of the succeeding crop. The fungicides tested were equally efficient in preventing leaf blight. Irrigation for tomatoes gave negative results this year.

Experiments with peppers (pp. 336, 337).—Experiments designed to test the value of fungicides for the prevention of the fruit anthracnose gave negative results, all being apparently without effect.

Experiments with eggplants (pp. 337–340).—In continuation of the experiments reported in the Annual Report of the station for 1895 (E. S. R., 8, p. 894) the diseases of eggplants were investigated. The season was very favorable for the development of fungi, and on both sprayed and unsprayed plants only about a third of the fruits were marketable.

A stem disease appeared that did not seem to be affected by any of the fungicides used. As shown in the previous report, Bordeaux mixture reduced the amount of disease where the plants were grown on fresh soil. The growing of 2 successive crops of eggplants on the same soil is believed inadvisable.

Experiments with cucumbers (pp. 340–344).—After summarizing the results of his previous year's work (E. S. R., 8, p. 395) the author gives an account of the experiments conducted in 1896 for the prevention of mildew and anthracnose of cucumbers. Owing to the early destruction of the vines by insects the results are hardly conclusive. The fungicides seemed to act to some degree as repellants toward the insects, as the sprayed vines were the last to be destroyed. The leaf blight was prevented to a considerable degree by the fungicides used. The fruit rot was about 5 per cent worse on the plants which were sprayed with the potash solution.

Experiments with celery (pp. 344, 345).—Negative results are reported on the use of fungicides for the prevention of celery blight, there being no disease manifest on any of the plants.

Experiments with peas (pp. 345, 346).—Investigations were conducted for the prevention of the leaf blight (*Ascochyta pisi*) and mildew (*Erysiphe martii*) on peas. A quick-growing variety, First of All, was chosen for the trial, the object being to get several successive crops in one season. No apparent effect from blight was found in the first crop. Irrigation materially increased the yield of vines and pods. In the second crop old seed and new seed from the crop just harvested were planted to the evident advantage of the new seed. Soil treatments of sulphur, corrosive sublimate, carbonate of lime, and copper sulphate were tested with the expectation that they would check the disease coming on the stems near the ground. The best yields were secured where the carbonate of lime was employed. But very slight differences were observed in the amounts of blight on the different plats. On the third crop the effect of Bordeaux mixture in keeping off the diseases from late peas was very evident.

Experiments with beets (pp. 346–350).—Experiments were conducted for the prevention of some of the fungus attacks of beets, principally *Cercospora beticola*, which was described in Bulletin 107 of the station (E. S. R., 6, p. 905). The fungicides were efficient in increasing the yield of the treated plats, although the ammonia-Bordeaux mixture burned the foliage to a considerable degree.

The identity of the scab upon potatoes and beets was clearly established by a field inoculation.

Experiments with sunflowers (pp. 350, 351).—A test was made of fungicides for the prevention of attacks of *Puccinia tanaceti* on sunflowers. Twelve sprayings were given the plats, and it was found that all the fungicides were active in keeping down the fungus. Those plants receiving what was called the ammonia-Bordeaux mixture were almost entirely free from rust pustules.

A stem blight due to *Phlyctæna* sp. was noticed on some of the plants and it did not seem to yield to applications of fungicides. An allied species of this fungus has been reported on cosmos.

Experiments with onions (p. 352).—Tests were made in the greenhouse with sulphur and corrosive sublimate for the prevention of onion smut due to *Urocystis cepulæ*, but no disease appearing in either check or treated lots, the results were negative.

Experiments with corn smut (p. 352).—Negative results similar to the above were obtained from experiments on the prevention of smut carried on in the greenhouse.

Fungicides and spraying (pp. 352–378).—Formulas for the fungicides used in the above experiments, details of application, and notes on their behavior toward the different plants are given. The principal fungicides employed were Bordeaux mixture and 3 modified solutions in which the lime of the Bordeaux mixture was replaced by soda, potash, and ammonia. The experiments above mentioned with lime, corrosive sublimate, kainit, copper sulphate, sulphur, etc., are reviewed.

Experiments with ornamental and other plants (pp. 396–400, 405–413).—Experiments are briefly reported on attempts to combat blight of peonies, leaf spot (*Cercospora cercidicola*) of Japanese redbud, leaf blight of hollyhock due to *Cercospora althæina*, diseases of gladiolus, prevention of rust of china asters caused by attacks of *Coleosporium sonchi-arvensis* (?), and experiments with sweet peas and stem blight (*Phlyctæna* sp.) of cosmos. Experiments reported with water lily blight indicate that Bordeaux mixture will prevent the disease, although the incrustation on the leaves is objected to.

The rust of asparagus is reported upon at considerable length. The fungus *Puccinia asparagi* seems to be spread along the Atlantic coast from Virginia northward. All varieties seem equally susceptible except the Palmetto. This seems thus far to be partially resistant. Burning the dead tops in the fall is recommended.

Notes are given on a nasturtium blight, an ampelopsis blight, an anthracnose of magnolia, a blight of chestnut, and a blight of linden.

Experiments with peach root galls (pp. 413, 414).—The application of sulphur about the roots of the seedlings seemed to indicate that it could be relied upon for the prevention of the root galls. There appears to be no connection between the cause of the galls on the peach roots and those on raspberry roots.

Siftings from other sources (pp. 415–429).—Under this heading are given abstracts of various publications of the stations and of this Department.

Bacteriosis of carnations, A. F. WOODS (*Bot. Gaz., 24 (1897), No. 3, pp. 200–205*).—The author has investigated the d:seases of carnations described by Arthur and Bolley[1] as bacteriosis of carnations. He concludes that the disease is not due to bacteria, as has been supposed, but to the punctures of aphides and thrips. The cells affected become œdemic, collapse, and give a whitish sunken area. In the early stages no bacteria or fungi are associated with the disease, though the dead tissue may be infected later. Proper selection and propagation of stock and keeping down as far as possible the aphides and thrips are recommended as measures for preventing the disease.

[1] Indiana Sta. Bul. 59 (E. S. R., 8, p. 235).

The Bermuda lily disease, A. F. WOODS (*U. S. Dept. Agr., Division of Vegetable Physiology and Pathology Bul. 14, pp. 15, figs. 4*).—A preliminary report is given of investigations conducted to ascertain the causes and means of prevention of the lily disease. This disease is characterized by the spotting and distortion of the leaves and flowers and usually the stunting of the plant, and it quite seriously affects the varieties of *Lilium longiflorum* and *L. harrisii* and also attacks *L. auratum* and *L. candidum*. The disease is said to be very prevalent in Bermuda and in the United States, where it frequently destroys 20 to 60 per cent of the crop.

The principal causes of the disease are said to be worn-out soil, premature removal of flowers and flower stems, premature harvesting of the bulbs, carelessness in the selection of stock for propagating purposes, bad treatment during forcing, and the work of insects. The investigations of the author seem to indicate that the disease is due to a combination of these causes. Bulbs become weakened through improper selection and propagation, and this weakening is further increased by attacks of mites and certain fungi and bacteria. During the forcing of the plants the bulbs may be weakened by overwatering or by allowing the roots to become too dry and then overwatering, the leaves of such plants usually being badly diseased. The spotting and distortion of the foliage is often due to the direct attack of several species of aphides and the young of the bulb mite, the injection of water into the leaves in watering by syringing, and the presence of water between the leaves of plants having soft foliage.

The means suggested for prevention of the disease are necessarily numerous. Among those apparently most important are proper cultivation, selection, and propagation so as to improve the stock; crop rotations should be practiced in order to prevent the increase of mites and injurious fungi; the stems should be left on the bulbs to secure their proper ripening, and care should be used in planting. All injured bulbs should be thrown out and planting should be done in well-drained and well aerated soil. As far as possible attempts should be made to keep down injurious insects from the start, and great care should be exercised in watering and ventilating. Chemical fertilizers are recommended in place of barnyard or other manures.

Sooty mold of the orange and its treatment, H. J. WEBBER (*U. S. Dept. Agr., Division of Vegetable Physiology and Pathology Bul. 13, pp. 44, pls. 5*).—This bulletin is in continuation of investigations given in Circular 15 and Bulletin 8 of this Division (E. S. R., 6, p. 737; 8, p. 59). In the present bulletin the author has given rather extendedly the life history of the fungi (*Meliola penzigi* and *M. camelliæ*) causing the disease. The sooty mold is considered a saprophytic fungus, deriving its nourishment wholly from the honeydew secreted by various insect pests which the fungus invariably follows. The most important of these insects is the mealy wing or white fly (*Aleyrodes citri*). In experiments with various sprays and washes resin wash, resin compound, an emulsion of pyrethrum and kerosene, and a resin wash containing a tobacco decoction proved very effective. Fumigation with hydrocyanic acid gas has also given excellent results. The treatment for sooty mold should be made during winter, in May, and in August or the early part of September. The trees should be given 2 or 3 sprayings during the winter and 1 in May, another application being made during August if the fungus is found to be spreading to the fruit.

Several entomogenous fungi have been discovered which will probably greatly aid in holding in check the sooty mold and the pests which it follows. The first of these (*Aschersonia aleyrodis*, n. sp.) is parasitic on the larvæ and pupæ of the mealy wing, and has been found very abundant in many groves infested with sooty molds. Only the larvæ and pupæ are subject to attack, infection taking place most commonly in the young larvæ. The fungus is fully described and its life history well worked out. A second fungus parasite, to which the name "brown fungus of the mealy wing" has been given, gives evidence of being more effective in its attack than the previous one. The relationships of the fungus can not be given, no fruiting bodies having been found. In the grove where this fungus was first discovered its spread was so rapid during the summer that the mealy wing was almost wholly eradicated.

Notes are given of other fungi which attack scale insects on several other plants.

A seedling disease of cacti (*Monatsschr. Kakteenkunde, 7 (1897), No. 12, p. 188*).—A brief note is given of a disease of cactus seedlings. Examinations of material revealed the presence of a sterile mycelium that is thought to be the cause of the disease.

A disease of the mammoth tree of California (*Meehan's Mo., 7 (1897), No. 12, p. 230*).—A note is given of *Cercospora sequoiæ*, which is said to seriously interfere with the growth of *Sequoia gigantea* in the eastern States.

A new disease of cauliflowers (*Jour. Agr. and Ind., South Australia, 1 (1897), No. 4, p. 343*).—A brief note is given of a disease of roots of cauliflowers, due to a species of Phoma.

A disease of clematis, P. SORAUER (*Ztschr. Pflanzenkrank., 7 (1897), No. 4, pp. 255, 256*).—A brief note is given of a disease of *Clematis jackmanni*, which is caused by *Glœosporium clematidis*.

A sclerotium disease of tulip bulbs, F. LUDWIG (*Deut. Bot. Monatsschr., 15 (1897), No. 5, pp. 153, 154*).

A new leaf disease of coffee in East Africa, P. HENNINGS (*Ztschr. Trop. Landw., 1 (1897), No. 8, pp. 192, 193*).—Describes *Hemileia woodii*.

The diseases of fruit trees, C. BACH (*Wchnbl. Landw. Ver. Baden, 1897, p. 84*).

The gummy deposits in the sereh disease of sugar cane, A. WIELER (*Beitr. Wiss. Bot., 2. Abt., 1 (1897), pp. 29–140, pl. 1, figs. 23*).

New fungi parasitic on cultivated plants, G. POLLACCI (*Atti Inst. Bot. Univ. Pavia, 2. ser., vol. 5, pp. 8; abs. in Bot. Centbl., 72 (1897), No. 5, pp. 184, 185*).—The following new species are described: *Macrosporium violæ, Helminthosporium iberidis, H. lunariæ, Leptothyrium parasiticum, Cytosporella cerei, Pirostoma farnetianum,* and *Phyllosticta dammaræ*.

Recent investigations concerning the cause of potato rot, FRANK (*Ztschr. Spiritusind., 1897, Ergänzungsheft 2, pp. 7–9*).

The destruction of barley by a new fungus parasite, FRANK (*Wchnschr. Brau., 14 (1897), No. 42, pp. 518–520*).

The enemies of our gardens, L. LAFOREST (*Les ennemis de nos jardins. Abbeville: Paillart, 1897, pp. 318, ill.*).

The barberry as a carrier and distributor of grain rusts, J. ERIKSSON (*Landw. Vers. Stat., 49 (1897), No. 1–2, pp. 83–95*).—The author reviews the literature relating to this subject and shows that the barberry is a host plant for some phases of rusts, and on this account the destruction of all bushes in cereal-growing regions is advised. Directions for their eradication and control are given.

On the characteristics of the brown rust of wheat, J. ERIKSSON (*K. Landt. Akad. Handl. Tidskr., 36 (1897), No. 3, pp. 137–143*).

Concerning the parasitism of Aureobasidium vitis, L. MONTEMARTINI (*Riv. Patol. Veg., 6 (1897), No. 1–5, pp. 76, 77*).

On the destruction of amygdalin and helicin by molds, K. PURIEVITCH (*Compt. Rend. Soc. Biol. Paris, 1897, No. 25, pp. 686, 687*).

The nematodes of sugar beets, L. DE TOURVILLE (*Jour. Soc. Agr. Brabant-Hainaut, 1897, No. 36*).

Copper-lime sucrate as a preventive of leaf diseases of grapes, J. NESSLER (*Weinbau u. Weinhandel., 1897, No. 21, p. 189*).

On the compulsory combating of the grape Peronospora, DERN (*Ztschr. Landw. Ver. Hessen, 1897, No. 13, pp. 113–115*).

On the use of sulphate of iron for chlorosis of grapes, J. DUFOUR (*Chron. Agr. Cant. Vaud, 10 (1897), No. 23, pp. 626–632*).

Concerning the destruction of Heterodera schachtii, M. WILLOT (*Monit. Ind., 1897, No. 2*).

ENTOMOLOGY.

Proceedings of the eighth annual meeting of the Association of Economic Entomologists (*U. S. Dept. Agr., Division of Entomology Bul. 6, n. ser., pp. 100, figs. 5*).—At this meeting, held in Buffalo, New York, August 21 and 22, 1896, the following papers were read:

The evolution of economic entomology, C. H. Fernald (pp. 5–12).—The history of the subject is briefly traced from the earliest times to the present. In speaking of the future development of the subject, it is shown that the assistance of the chemist and the physiolgist will be needed.

Some temperature effects on household insects, L. O. Howard (pp. 13–17).—From temperature experiments performed to learn the degree of temperature that will prevent the ravages of the common clothes moth (*Tinea biselliella*), the black carpet beetle (*Attagenus piceus*), the leather beetle (*Dermestes vulpinus*), the dark meal moth (*Tenebrio obscurus*), and the cabinet beetle (*Trogoderma tarsale*), it was found that during summer months a temperature of 40 to 42° F. is sufficiently low for the purpose indicated.

A three years' study of an outbreak of the chinch bug in Ohio, F. M. Webster (pp. 18–25, maps 4).—This is the same as Ohio Station Bulletin 77 (E. S. R., 9, p. 67).

A new insecticide, A. H. Kirkland (pp. 27–29).—It was found by the author that arsenic in soluble form transfuses the cells of plants and plasmolyzes the protoplasm, and that this plasmolysis is in direct ratio to the solubility and quantity of the compound employed. The burning point of barium arsenate is stated to be reached when it is used at the rate of 20 lbs. to 150 gal. water; that is, upon oak and apple. Larvæ in the second, third, and fourth molt, it is stated, are killed within 5 days when sprayed with this compound in the proportion of 3, 4, and 5 lbs. to 100 gal. water; while larvæ in the fifth molt require 10 to 20 lbs.

The barium arsenate is obtained by precipitating arsenate of soda with a soluble barium salt, such as barium chlorid.

Comparative tests with new and old arsenicals on foliage and with larvæ, C. L. Marlatt (pp. 30–35).—Paris green, pulverized Paris green, Scheele's green, London purple, and arsenite of lead, both with and without an admixture of lime were employed. The first 3 were used in strengths of 1:160; 1:100; 1:80; and 1:53⅓. The London purple and a mixture of equal parts of Scheele's green and arsenite of lead were employed at the rate of 1:160 and 1:100. No injury resulted. But in another series of tests made on peach, apple, and cherry, in which the poisons were used at the rate of 1:100, some damage was done, as shown by the following table:

Injurious effects of Paris green, Scheele's green, and London purple.

Poison.	Peach.	Apple.	Cherry.	Cotton.
Paris green, ordinary	½ leaves lost	Very slight spotting.	No injury	No injury whatever.
Paris green, pulverized	¾ leaves lost	All more or less spotted.	Injury slight—insignificant.	Do.
Scheele's green	⅚ leaves lost	do	do	Do.
London purple	All leaves lost.	Much scalded, including edges.	do	Do.

The effect of arsenicals seems to be to hasten the ripening of the leaves and perhaps also of the fruit.

In experiments on larva, no noticeable difference between the poisons was found when used at the rate of 1: 80. Used at the rate of 1:160, they gave somewhat unsatisfactory results. When used at the rate of 1:100, Paris green and Scheele's green show but little difference, either when used alone or with lime. London purple and arsenite of lead are much slower in their action.

The number of grains of active poisonous principle held in solution in each gallon of mixture when the latter is made in the proportion of 1:100 is stated to be as follows: Ordinary Paris green, 0.87; pulverized Paris green, 1.18; Scheele's green, 2.50; London purple, 7.93; arsenite of lead, 0.94.

Summarizing all his experiments, the author states that Scheele's green and arsenite of lead are to be preferred to any of the others.

On the futility of trunk and crown washing against the elm leaf beetle, L. O. Howard (pp. 36–38).—It is concluded that fully 70 per cent of the insects drop from the limbs and that this demonstrates the superiority of spraying over other methods of combating this insect.

Insecticide soaps, C. L. Marlatt (pp. 38–41).—Some 18 soaps were tested to learn whether when dissolved at the rate of 2 gal. water to 1 lb. soap they would remain liquid. Nine remained liquid even when placed in refrigerators at a low temperature, while the rest remained solid even at summer temperatures. The percentage of water contained in soaps was found to have nothing to do with their remaining liquid. It was also learned that the kind of lye employed is immaterial. Fish oil or other oily soaps are thought best.

Scale insects and their enemies in California, J. B. Smith (pp. 46–48).—An abstract of the author's report in the Annual Report of the New Jersey Experiment Station for 1896.

Notes on some of the insects of the year in the State of New York, J. A. Lintner (pp. 54–61).—A somewhat unusual absence of the attacks of several common pests is noted. Some of the insects mentioned are *Vanessa atalanta*, *Leucania unipuncta*, *Anisopteryx vernata*, *Cacœcia rosaceana*, *Nolophana malana*, *Euphoria inda*, *Elaphidion villosum*, *E. parallelum*, *Crioceris asparagi*, *Macrobasis unicolor*, *Aspidiotus perniciosus*, *Kermes galliformis*, and *Gossyparia ulmi*.

Entomological notes from Maryland, W. G. Johnson (pp. 63–66).—The nursery stock law of Maryland is discussed. The recognized impossibility for even the expert to be certain that scales have been exterminated impels the author to suggest that a certificate should be required from nurserymen stating that their stock has never been infected or subject to infection and that they will assume all responsibility should their belief prove unfounded.

The following insects are noted: *Crioceris asparagi*, the potato stalk weevil (*Trichobaris trinotata*), *Doryphora 10-lineata*, *Epicauta cinerea*, the strawberry weevil (*Anthonomus signatus*), the plum curculio (*Conotrachelus nenuphar*), codling moth (*Carpocapsa pomonella*), fruit bark beetle (*Scolytus rugulosus*), European elm leaf beetle (*Galerucella luteola*), and a locust leaf beetle (*Odontota dorsalis*).

Insects of the year in Ohio, F. M. Webster (pp. 66–71).—This was reprinted in the author's annual report (E. S. R., 8, p. 998). In the discussion that followed a probably new apple trypeta and a possibly new bagworm were noted, and the injurious effect of surrounding trees with cotton bands saturated with oil brought out.

Some notes on observations in West Virginia on farm, garden, and fruit insects, A. D. Hopkins (pp. 71–74).—The 5 localities in the State where the San José scale occurs are mentioned and the following insects noted: The scurfy bark louse (*Chionaspis furfurus*), the rose scale, the plum scale, webworm, the harlequin cabbage bug, blister beetle (*Epicauta pennsylvanica*), and a clover seed pest (*Bruchophagus* (*Eurytoma*) *funebris*) formerly thought to be parasitic on the clover midge (*Cecidomyia leguminicola*), and bumblebees.

Notes on new and old scale insects, W. G. Johnson, (pp. 75–78).—The insects noted are the cherry scale (*Aspidiotus forbesi*), *A. uvæ*, *A. ulmi*, *A. æsculi, A. aurantii, A. camelliæ, A. ancylus, A. nerii, A. juglans-regiæ, Mytilaspis pomorum, Chionaspis furfurus, C. salicis, C. pinifoliæ, Diaspis rosæ, Lecanium persicæ, Prospalta murtfeldti, P. aurantii, Perrisopterus pulchellus, Signiphora nigrita, Arrhenophagus chionaspidis, Ablerus clisiocampæ,* and *Chilocorus bivulnerus.*

Notes on the entomological events in 1896 in Ohio, H. Osborne (pp. 78–80).—The army worm did considerable damage as a first brood; the second, which appeared in July, threatened injury, but was severely attacked by *Microgaster militaris.* The other insects noted are a leaf hopper (*Empoa albipicta*), an enemy of potatoes, *Aspidiotus rosæ,* the hickory bark beetle (*Scolytus 4-spinosus*), the Hessian fly (*Cecidomyia destructor*) which was accompanied by its parasite (*Semiotellus destructor*), and the elm span worm (*Eugonia subsignaria*), which is said to have defoliated large tracts of timber land.

Is cooperation for the control of the San José scale practicable, W. G. Alwood, (pp. 80–84).—After considering the numerous difficulties involved, it is concluded that it would be impracticable to enact a general law by the different States affected with the scale and that the matter should be taken up by the General Government. The great need of systematic inspection and treatment of infected stock is brought out.

The development of the Mediterranean flour moth, F. H. Chittenden (pp. 85–88).—The life cycle was found to vary from 38 to 114 days, the usual length of time necessary being from 38 to 52 days. The egg state lasts from 4½ days to as long as 2 weeks. The pupal period lasts from 8 to 27 days and the larval period from 24 to 25 days.

A grasshopper disease in Colorado, C. P. Gillett (pp. 88–92).—Grasshoppers were found attacked by a bacterium resembling *Bacterium termo.* It was found that *termo* from beef broth sprayed on alfalfa and fed to healthy hoppers had the same effect as the germs from the insects, killing them within 48 hours; and when inoculated directly into the body, killing within 24 hours. The disease was found to spread readily and over a large extent of country. Soon after some of the experiments were performed in which dead and diseased hoppers were mixed with water and sprayed on the food plants dead hoppers were found over a mile away. The rearing of *Sarcophaga cimbisis, S. sarraceniæ, S.* sp., *Cyrtoneura stabulans, Helicobia helicis, Aphæreta muscæ,* and *Perilampus* sp., is noted. The bacterial disease is said to be most prevalent in a wet time and upon low ground, and is confined mostly to 2 species, *Melanoplus bivittatus* and *M. femur-rubrum.* It is thought to be present in most localities in the State, at least to a small extent.

A simple device for the preparation of oil emulsions, H. A. Morgan (pp. 93, 94, fig. 1).—A 4-inch tin cylinder, from 20 to 24 in. long, provided with 7 small openings and a plunger, consisting of a tin cone and a ⅜-in. iron rod, is described.

Following this paper is the constitution and by-laws of the association and a list of the members.

Report of the entomologist, J. B. SMITH (*New Jersey Stas. Rpt. 1896, pp. 433–563, figs. 16*).—This voluminous report is devoted largely to a consideration of the San José scale in California and other parts of the United States, with especial reference to the best means of dealing with it in New Jersey. There is besides this a discussion of the insects most injurious during the year in New Jersey. Among these the army worm is mentioned as having appeared in very destructive numbers in various parts of the State. This insect is described in detail, its life history, natural enemies, and the proper remedial measures are discussed. From several places it was reported as attacking oats, wheat, rye, grass, and corn. Its distribution was somewhat irregular and, as a whole, comparatively little injury was done, it being confined in some cases to single fields. In no place did it appear as a second brood.

The number of worms is controlled by climatic conditions that favor the development of disease and by natural enemies such as *Calosoma calidum* and the fly, *Nemorea leucaniæ*. The most practical remedy, the author thinks, is poisoned bran, but if this is unavailable the furrow barrier remedy may be resorted to, or, if the insects are in a small area, kerosene may be used. In any case remedial measures should be taken early.

Other insects noted in the general review as injurious during the year are the melon louse, which caused considerable financial loss; the Hessian fly, strawberry leaf roller, root lice, strawberry weevil, cutworms, wireworms, currant spanworm, and the caterpillars of the cabbage butterfly; the last were exceptionally numerous. There was scarcely a field in some portions of the State which was not seriously injured.

Injuries were also done by the oak pruner, hay worm, pear midge, pine sawfly (*Lophyrus abbottii*), vine leaf hopper (*Erythroneura vitis*), maple pseudococcus (*Pseudococcus aceris*), tulip soft scale (*Lecanium tulipifera*), click beetle (*Monocrepidius respertinus*), locust leaf beetle (*Odontota dorsalis*), and the harlequin cabbage bug (*Murgantia histrionica*). The last insect, it is stated, has hitherto not been injurious in New Jersey. The reports of its ravages were first received from Camden.

Discussing the subject of sprays it is noted that a spray made of 1 lb. arsenic to 200 gal. of water will be perfectly safe and effective in the case of currants if applied 2 weeks before picking time. Hellebore, ordinarily effective against the currant worm, was tried against the spanworm with little success.

The author's experience with Dendrolene during the year was much the same as in the previous season. Applied thick and allowed to remain on thin barked trees it causes injury. Since chemical tests show that it is neither acid nor alkali and is not poisonous, the injury is thought to be due to the penetration of the greasy substance into the plant cells.

The results of correspondence relative to the common injurious insects, some of which have already been named, are briefly summarized:

In his historical review of investigations on the San José or pernicious scale (*Aspidiotus perniciosus*) the author states that probably the insect was introduced into South America (its supposed original home) on trees from California, for it has not yet been found there on native plants. It has been supposed to have originated from Australia, the Pacific islands, and Japan, but no known facts justify a definite statement as to its originating in any of these places.

The history of the scale in the United States is briefly discussed, and its introduction into New Jersey is treated at some length. On the recommendation of the State board of agriculture the State legislature in 1896 appropriated $1,000 for studying the scale. The author made a trip through the Southwest, California, and into Oregon to study the scale, and an account of this journey is given. The accounts of various people in California were very conflicting, with the exception of those relating to the usefulness of *Vedalia cardinalis*, which is stated to have almost exterminated the cotton cushion scale (*Icerya purchasi*). In Santa Barbara olive orchards once badly infested with the black scale were found among the cleanest seen, and this difference in condition was said to be due to coccinelids entirely. Of these *Rhizobius ventralis* was claimed to be most active. At Los Angeles the twice stabbed ladybird (*Chilocorus bivulnerus*) is chiefly relied upon in combating the pernicious scale. At other places no dependence whatever was placed upon predaceous insects, but a resinous spray was used as a remedy. In other localities sprays were in disrepute.

Relative to Rhizobius the author states that *R. debilis* plays the most important róle in the destruction of the scale, and that this species is found abundantly only in Santa Barbara County. What was called *R. debilis* elsewhere was found upon investigation to be *R. lophantæ* or *Scymnus marginicollis*.

Resummarizing his discussion and bringing out the question of the desirability of introducing predaceous insects into New Jersey, the author says, in substance, that the conditions in California can not be duplicated in New Jersey. South of San Francisco some six or eight weeks before the scale begins to reproduce it is preyed upon by *Chilocorus bivulnerus* and *Aphelinus fuscipennis*. In some places these insects may feed upon it during its entire dormant period. When the scale is most sluggish and reproducing slowly (during the hottest season) *Rhizobius lophantæ* is most active. In New Jersey *C. bivulnerus* and *A. fuscipennis* are native. *R. lophantæ* might be introduced, but it would be at a disadvantage, since it would not get as early a start as in California, nor would it be favored by a decreased activity of the scale.

Further, the scale has in New Jersey the advantage over all its enemies by breeding a month longer than they do. Another reason unfavorable to the introduction of the beetle is that clean culture is more or less inimical to it.

In California where orchards were practically abandoned and became filled with rubbish the beetles flourished, finding sufficient shelter for the mild winters. In New Jersey, a much colder climate, much greater shelter would be necessary, and in its well-cultivated orchards very little would be found. Especially would this be the case in orchards of deciduous trees. From these facts the author concludes that even if the beetles should be introduced from California, and should do just as well as they have done there, the New Jersey orchardists would not be justified in relying on them to prevent or lessen the ravages of the San José scale. In southern California climatic influences, combined with the attacks of the natural enemies, keep the scale in check. The natural enemies alone could not do so, and any dependence upon them in New Jersey will, in the opinion of the author, result in disaster. If anything is done example must be taken from northern California, where the natural conditions much more nearly resemble those of New Jersey.

The remainder of the report is devoted to discussing (1) the relation of injurious insects to their enemies, and (2) the natural enemies of the San José scale, under which heads the author contradicts the quite popular idea that one may array the forces of nature against one another with entire success.

It is believed that natural enemies of the scale could not be introduced from California into New Jersey with a good prospect of their becoming sufficiently abundant within a measurably short time to be of much use in keeping the scale in check. The diseases of the scale are briefly treated, and a record is given of the insects introduced into New Jersey as a result of the author's western journey.

With reference to remedial measures, receipts are given for the lime, sulphur and salt wash, and for resin washes; the methods of using kerosene soaps and potassium cyanid are described; and the following recommendations are made:

"(1) Destroy infested stock whenever practicable; (2) spray thoroughly as soon after the trees become dormant as possible, with fish-oil soap, 1 lb. in 1 gal. of water; (3) spray again in early spring, before the buds begin to swell, with fish-oil soap, 2 lbs. in 1 gal. of water, and do it thoroughly; (4) cut back or prune the treated trees a few days after spraying, so as to leave no more wood than absolutely necessary for the use of the tree and crop; and (5) on scaly trees use whitewash liberally throughout the summer, keeping the trunks and branches covered with lime as thoroughly as possible."

Some miscellaneous results of the work of the Division of Entomology, L. O. HOWARD (*U. S. Dept. Agr., Division of Entomology Bul. 7, n. ser., pp. 87, figs. 44*).—This publication is designed in a measure to take the place of Insect Life and includes the following articles:

The ambrosia beetles of the United States, H. G. Hubbard (pp. 9–30).—A popular summary of what is known concerning various species of ambrosia (Platypus, Xyleborus, Corthylus, Monarthrum, Xyloterus, and Gnathotrichus), found in the United States.

Grasshopper report for 1895, L. Bruner (pp. 31–35).—A brief account of an excursion into Colorado and the Northwest to investigate the locust conditions of those regions. In the neighborhood of Denver, Golden, and Fort Collins the most abundant insects observed were *Melanoplus bivittatus*, *M. atlanis*, *M. fœdus*, *M. packardi*, and *Dissosteira longipennis*. The damages caused by these locusts, though comparatively light, were sufficient to warrant the settlers in taking decisive action. Numbers of the insects were attacked by *Empusa gryllæ*. To the heavy rains which were followed by a rank growth of vegetation the author attributes the bunching and the eastward and northward spread of the long-winged species. Between Cheyenne, Wyoming, and Oreno Junction, Wyoming, where the hoppers had been particularly numerous in previous years, few were found, in consequence, apparently, of a series of cold rains during the months of May and June. Near Laramie City *Camnula pellucida* was found very abundant in places, but the other species were not present in even moderate numbers. North of Ogden the most numerous species were *Melanoplus bivittatus* and *M. atlanis*. In some places *Camnula pellucida* was present in more than ordinary numbers. At Logan most of the commoner species were abnormally abundant. At Pocatello, Idaho, slight indications of locusts were noticed. Along the Snake River and thence to Colfax, Pullman, Moscow, Lewiston, and Waha, they were found to have done more or less injury and in many places were still active. Among the species observed were *Melanoplus femoratus*, *M. fœdus*, *M. atlanis*, *Camnula pellucida*, and *Dissosteira obliterata*.

As a result of his observations the author concludes this year was one of unusual drought for this part of the country, and that, as the grass on the hillsides and in the pastures was shorter than usual and consequently sooner grazed off by the stock, the hoppers were forced to move to cultivated grounds; and, taking the region as a whole, considerable damage was done, although no single district may be said to have been completely devastated. The hoppers appear to be on the increase, but there is no apprehension of an invasion from the Rocky Mountain locust at any point, although there may, and probably will, be local outbreaks of native species.

Grasshopper report for 1896, L. Bruner (pp. 36–39).—This records a journey undertaken to investigate reports of grasshopper injuries in Nebraska, Dakota, Kansas, Minnesota, Iowa, and Colorado. Some of the early reports were found to be largely caused by *Melanoplus spretus*. Later reports from north of the Platte River were found to be caused by the long-winged plains locust, *Dissosteira longipennis*. Investigation showed the insects were not in such numbers as to cause great injury except in isolated districts. The other species found to be destructive in Nebraska and adjoining States were *Melanoplus atlanis*, *M. femur-rubrum*, *M. bivittatus*, *M. differentialis*, and *M. lakinus*. *M. atlanis* was noted in portions of Colorado and Kansas and in the central half of Nebraska, western Iowa, and some parts of South Dakota and Minnesota as very plentiful. At Lincoln it showed a tendency to migrate during the month of September. In Colorado and western Kansas the hoppers were found to be attacked by *Empusa gryllæ* and consequently upon the decline. At Colorado Springs and vicinity *Melanoplus lakinus* seemed to be on the increase and to have apparently passed the danger line. *Dissosteira longipennis* was especially noted as having attacked cultivated plants not before included in its list of food plants. In the vicinity of Lodge Pole fields of small grain were destroyed by it; some corn, potatoes, and a number of garden plants were destroyed by it. In the vicinity of Sidney large numbers of a long-legged tachnid fly were found apparently attacking and destroying the locusts.

Some insects affecting the hop plant, *L. O. Howard* (pp. 40–51).—Brief notes on the hop plant borer (*Hydrœcia immanis* and *Hypena humuli*), the semicolon butterfly (*Polygonia interrogationis*), and comma butterfly (*P. comma*).

The plum plant louse (*Myzus mahaleb*), *T. Pergande* (pp. 52–59).—Myzus is to be distinguished from Phorodon by gibbous frontal tubercles and the absence of a tooth in the first antennal joint in the case of Myzus and by the tubercles being prolonged into a permanent slender prorected tooth and by the first antennal joint being bluntly but distinctly gibbous in the case of Phorodon. The food plants of various species and the life history of *M. mahaleb* are considered and the characteristics of the insect in each of its 3 different genera described in detail. The apterous females sometimes occur in the third generation, but differ from those of the second nearly as much as the second from the first generation. They are very similar and are to be considered a migratory form destitute of wings. Return migrants or pupiferous females are said to resemble closely those of previous generations, but they are generally larger and stouter and have all the markings more intensified. By the time the earliest sexual females are fully matured, which may be in about 3 or 4 weeks, the return migrants again become numerous and last until about December.

The rose leaf beetle, *F. H. Chittenden* (pp. 60–61).—The author notes that *Nodonota puncticollis* has been confounded with *N. tristis*, *N. clypealis*, and *N. convexa*. The different species may be identified by recollecting that *N. tristis* feeds on Lespedeza, Ceanothus, and other upland weeds; *N. clypealis* on ambrosia in river bottoms; *N. convexa* in the same situations, and *N. puncticollis* on wild and cultivated roses, blackberries, raspberries, strawberries, and red clover. He proposes to call this species the rose leaf beetle, since it seems to prefer that plant.

A case of excessive parasitism, *L. O. Howard* (pp. 62, 63).—The author describes a new species (*Coccophagus fletcheri*) and records that from 80 specimens of *Lecanium fletcheri* received on 4 little twigs of *Arbor vitæ* from Ottawa, June 17, 1896, as many as 127 parasites emerged within 10 days. As the holes made by the emerging numbered 180 and as but a single parasite is known to emerge from one hole, many parasites must have emerged previous to the receipt of the specimens. This, in connection with other facts, indicates that the insects were parasitized to the extent of 97.5 per cent. Not a single hyperparasite was found among the 6 different species of 5 distinct genera of parasites that emerged.

The walnut spanworm, D. W. Coquillett (pp. 64–66).—Notes on the spanworm (*Boarmia plumigeraria*) which appeared late in the summer of 1890 in very considerable numbers in Santa Barbara County, California, upon the leaves of the English walnut. Previously it had not been known as an injurious insect. It has also been found upon the leaves of the apple, prune, and oak. The life history of the insect is given. A tachinid and an ichneumon of the genus Apanteles have been found parasitic upon the worms. Different birds, especially the blackbirds, have been noted as particularly fond of them. The most efficient remedy is considered to be a spray of Paris green in the strength of 1 lb. of the poison to 200 gal. water. If to each 100 gal. of the solution 10 or 12 lbs. of soap are added, the efficacy of the solution will be increased and spraying facilitated.

Insect injury to chestnut and pine trees in Virginia and neighboring States, F. H. Chittenden (pp. 67–75).—The author treats here of the buprestid *Agrilus bilineatus*, and the scolytid bark beetle, *Dendroctonus frontalis*, which have been charged with killing chestnut trees, especially in the region southeast of the Blue Ridge Mountain range. Save in exceptional cases, perfectly healthy forest growths seldom succumb to insect attack and the cause of the injury must be sought in some predisposing agency producing a weakened condition of the timber. The primary cause of such injuries may be attributed to what is known as winter desiccation, or pine blight.

The author also describes the result of his visits to the infested regions. *Agrilus bilineatus* is briefly described and an undoubted parasite upon it (*Spathius simillimus*) noted. Complaints received from Virginia, West Virginia, and the District of Columbia that the pines were severely attacked were investigated and the damage found to be caused by *Dendroctonus frontalis. Leptostylus commixtus*, *Graphisurus pusillus*, and *Acanthocinus nodosus* were also found injuring pines.

The severe wind storms that occurred in the south Atlantic States during the year 1895 caused the destruction of forest and shade trees which then offered an excellent opportunity for the propagation of insects. To prevent still greater destruction of trees by these insects, the author states that those sufficiently interested should clear up the dead and trim the injured trees, and that all dead oaks ought to be burned. Besides this the plan followed in Europe might be adopted, which is to girdle certain trees here and there in the forest which form trap trees which may later be cut down and burned. Raupenleim and Dendrolene might also be used upon the trunks and lower branches of shade trees for preventing the oviposition of eggs. A wash of lime poisoned with Paris green, rendered sticky by a little glue, might be used for the same purpose.

General notes, L. O. Howard (pp. 76–84).—Under this head *Gelechia piscipellis*, *Olliffiella cristicola*, the white pine butterfly (*Neophasia menapia*), the strawberry weevil (*Anthonomus signatus*), the scolytid (*Xyleborus tachygraphus*), the harlequin cabbage bug, meal worms (*Tenebrio obscurus*), the coccid (*Aonidia fusca*), the San José scale (*Aspidiotus perniciosus*), the common mealy bug of Europe (*Dactylopius adonidum*), and the apple insects (*Cacœcia responsana* and *C. excessana*), are noted.

Notes from correspondence (pp. 84–87).—Miscellaneous notes including notes on the red winged starling (*Agelæus phœnicus*), the cottonwood leaf miner, a migration of *Colias cæsonia*, the bollworm damage to strawberry plants, scolytid beetle (*Xyleborus pubescens*, *Monarthrum mali* and *M. fasciatum*), an unwelcome insect imported by the World's Fair, Oreodera in the West Indies, a new locality for *Bruchus obsoletus*, hippelates flies, early and new appearance of the horn fly, and a man-infesting bot (*Dermatobia cyaniventris*).

The San José scale and its nearest allies, T. D. A. COCKERELL (*U. S. Dept. Agr., Division of Entomology Bul. 6, tech. ser., pp. 31, figs. 15*).—The characteristics which distinguish these closely related injurious scale insects are considered. The characteristic features of scale insects belonging to the subfamily Diaspinæ and its genera are given and a key to a number of species of Aspidiotus.

It is noted that *A. cydoniæ* of Florida resembles *A. rapax*, and that the Mexican *A. crawii*, which is a fungus scale, is distinguished by the exuviæ not being dark. *A. perniciosus* is recognized with difficulty in the field, since *A. ancylus*, *A. forbesi*, and *A. howardi* closely resemble it. It is therefore recommended that a field diagnosis be confirmed by an examination of the insect beneath a compound microscope, if either locality or plant is new. *A. forbesi*, recently described from Illinois, is stated to have been found on apple trees in Mesilla, New Mexico.

The microscopic characters of the adult female, so far as of diagnostic value, are considered and figured with some detail.

The absence of ventral glands in immature females is noted as a diagnostic characteristic that is inconclusive. A close examination of the posterior marginal lobes in *A. perniciosus* will enable one to distinguish it from other forms. The median lobes are large, upright, and extero-marginally notched. The second lobes, though small, are distinctly set close to the first, varying slightly in shape, but inclining to be pointed, and like the other lobes are externally notched. The processes between the two lobes are well developed, close together, and of nearly equal size.

A comparison is made with the lobes of *A. ancylus*, *howardi*, *ostreæformis*, *juglans-regiæ*, *albopunctatus*, *obscurus*, and *crawii*. The differences in the ventral glands are brought out in the following table:

Ventral glands of the species of Aspidiotus.

	Median.	Cephalo-laterals.	Caudo-laterals.
A. perniciosus	None.	None.	None.
A. andromelas	None.	None.	None.
A. rapax	None.	None.	None.
A. juglans-regiæ	0 to 4	7 to 16	4 to 8
A. forbesi	1 to 3	3 to 7	3 to 5
A. ostreæformis (from England)	6	11	9
A. convexus	None.	7	4
A. ancylus	0 to 6	6 to 14	5 to 8
A. cydoniæ	None.	8 to 9	5 to 7
A. crawii	None.	5	4
A. uvæ (on grapevine)	0 to 2	4 to 9	3 to 8
A. obscurus	6	12	8
A. howardi	None.	6 to 7	3 to 4
A. patavinus (on cherry in Italy)	0 to 2	4 to 9	7 to 10

Comstock's division of the genus Aspidiotus into subgenera is commented upon and the various subgenera are considered at some length. Melanaspis (type *A. obscurus*), Mycetaspis (type *A. personatus*), Pseudaonidiæ (type *A. duplex*), Cryptophyllaspis (type *A. occultus*), Selenaspidus (type *A. articulatus*), and Xerophilaspis (type *A. prosopidis*) are suggested as new subgenera.

The author endeavors to prove that the San José scale is a native of Japan, upon the ground that 2 varieties or subspecies of *A. perniciosus*, namely, *andromelas* and *albopunctatus*, occur in that country which agree almost exactly in structural details with *A. perniciosus*. The question of origin is discussed at considerable length. The older idea of the Chilean origin of *A. perniciosus*, as well as the Australian origin, is more or less summarily dismissed, and the observation made that the supposed variety of *A. perniciosus*, found by Maskel on Eucalyptus in Australia, is not correct. The species of *A. diaspidiotus* of the United States are not thought very closely related to those of Europe. The American species differ in the median lobes being nearer and more inclined to be notched. The author notes a tendency in the American species to give off a group with pallid and usually flatter scales, which are found in the peripheral parts of trees, leaves, and even fruit. By this means he draws *A. howardi* from *A. ancylus*. *A. juglans-regiæ* is considered a very distinct form, suggesting in its scale *A. chrysomphalus*.

Under the head of habits of the species it is pointed out that *A. perniciosus* is partial to the Rosaceæ, as supported by the following list of host plants upon which it has been found: Apple, crab apple, quince, pear, Bartlett pear, dwarf Duchess pear, plum, Japan plum, Satsuma plum, *Prunus pissardi*, *P. maritima*, peach, apricot, almond, cherry, Rocky Mountain dwarf cherry, currant, black currant, *Citrus trifoliata* (*Albopunctatus*), osage orange, grape, elm, cottonwood, European linden, American chestnut, *Pyrus japonica*, *Catalpa bignonioides*, walnut, Japan walnut, loquat, red dogwood, juneberry, rose, sumac, *Photinia glauca*, and the Carolina poplar.

An annotated list of the 134 species of Aspidiotus is given. In a postscript the author accepts Leonardi's new genus Odonaspis and drops a subgenus proposed by himself of which *A. secretus* was the type. He objects to the grouping of the species by Leonardi[1] which throws into the same genus (Aonidiella) such different forms as *A. aurantii*, *perniciosus*, and *mimosæ*, while it places *perniciosus* and *ancylus* in separate genera.

Distribution of the San José scale in Virginia, W. B. ALWOOD (*Virginia Sta. Bul. 66, pp. 77–90, figs. 3*).—In May only 2 infected localities were known in the State, but as a result of personal inspection and correspondence since then the number of localities has been increased to 26, distributed through the entire State in 16 counties, including some 60 premises. Since the introduction of the pest into the orchard in Roanoke County 6 years ago it has increased so as to involve 10,000 trees in this county and 4,000 in the adjacent one of Botetourt. The distribution of the scale in the United States is also noted.

During the year all but a few small nurseries were inspected and were carefully watched. In this work the nurserymen of the State cooperated with the best of will. Where stock is known to be infested the author seems to advise its entire destruction and the treatment of only such stock as is suspected. Little faith is placed in washes for this latter purpose, fumigation being thought best.

For the purpose of fumigation of nursery stock, a two-roomed tight board building lined with paper and having a ground floor is described. The partition dividing the 2 rooms is tight, so that one room may be filled while fumigation is going on in the other.

More about the San José scale, C. F. BAKER (*Alabama College Sta. Bul. 86, pp. 451–456, figs. 2*).—The author states that the inspection of several nurseries in Alabama during the spring revealed the fact that this insect occurred but rarely or not at all on stock that was moved every 3 years, and he seems to advise such a movement of stock for the purpose of getting rid of the scale. The plan, it is stated on the authority of nurserymen consulted, is perfectly practicable.

Passing over a compiled list of the food plants of the insect, it may be noted that the Early Richmond cherry seems to be exempt from the San José scale. Trees of this variety have been growing with their branches interlocked with those of a pear that had been killed by the scale and yet remained uninfested. Again, two cases are noted where the Early Richmond variety was grafted upon Mahaleb stock. The shoots of the latter had sprung up below the graft and were badly infested, while none at all were to be found on the trees themselves.

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[1] Riv. Pat. Veg., 5 (1897), No. 9–12, p. 283–286.

A brief description is given of the scale, and brief notes on a sweet-potato pest which some years ago was reported from Ocean Springs, Mississippi, as being injurious. A few notes are also given upon carbon bisulphid, insecticides, and pumps in general.

The pear slug, C. L. MARLATT (*U. S. Dept. Agr., Division of Entomology Circ. 26, 2. ser., pp. 7, figs. 4*).—The characteristics and the history of the insect are briefly reviewed. It is noted that a comparison of specimens from Europe with abundant American material establishes the fact that the American pear slug, which has been known under the names *Selandria cerasi* and *Eriocampa cerasi* and considered as an American insect, is identical with the *Tenthredo limacina* of Retzius[1] (1783) placed in the genus Eriocampoides by Konow in 1890.

The life history and habits are described from the egg stage to the adult. In the latitude of Washington the eggs are laid in April; in that of Boston during the latter part of May and the first of June. At Washington many of the newly hatched larvæ perish during the cold and wet weather that often characterizes April. Where a good many eggs are found on one leaf the author is convinced that it is by different flies, or at least at different visits of the same individual.

Relative to the pupa it is stated that the author's observations confirm those of Peck, viz, that some larvæ of the spring brood remain unchanged as dormant larvæ during winter and transform in the spring. At Washington, it is stated, nearly all of the first brood larvæ disappear about the end of June and the first flies of the second brood begin to appear about June 20—in greater number about July 1.

As a parasite a species of Encyrtus is noted. The usual arsenical remedies are recommended; e. g., Paris green at the rate of 1 lb. to 250 gal. of water. A soap wash and forcible water spraying are thought effective.

The currant fly or gooseberry frit fly, L. F. HARVEY (*Maine Sta. Bul. 35, pp. 8, figs. 10*).—A brief history is given of the insect *Epochra canadensis*. From a study of the life history of the insect, which as a pest is new to the State, it is concluded that it is vulnerable only in the larval stage. The larvæ remain in the fallen fruit for some time, and such fruit may therefore be gathered up and burned. A correspondent suggests that chickens might be allowed about the bushes with good effect. It is also suggested that the pupæ may be destroyed by deep spading or by stirring the soil after cold weather so as to expose the pupæ. Mulching is also recommended.

Value of keeping bees on the ranch, A. J. COOK (*Amer. Bee Jour., 37 (1897), No. 30, pp. 470–471*).—Among other things, the keeping of bees on a small scale by farmers and ranchers, rather than by specialists, is advocated. It is suggested that the keeping of bees may be made a means of retaining the boys on the farm.

Feeding back extracted honey, G. M. DOOLITTLE (*Amer. Bee Jour., 37 (1897), No. 37, pp. 578, 579*).—It is thought by the author that those who think feeding back

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[1] See F. W. Konow, Tenthredinidae Europae, Deut. Ent. Ztschr., 1890, p. 239.

is a failure outnumber those who think the contrary. From his own experience he concludes that if anyone must feed back he had best do so in the spring so as to hasten brood rearing and at the proper time put on the sections; but he does not think the practice will pay in the long run since it is on the principle of producing two crops to get one.

Preparing honey for the market, G. M. DOOLITTLE (*Amer. Bee Jour., 37 (1897), No. 34, pp. 529–530*).—It is recommended that honey should be kept in a dry room where the temperature will be sufficient to ripen it (85 to 90°). This high temperature will cause the eggs of the moths to hatch, if there are any, so that daily inspection of the sections will enable one to discover and destroy the larvæ. This may be done by sulphur fumes.

The new Hoffman frame for 1897, E. R. ROOT (*Amer. Bee Jour., 37 (1897), No. 9, p. 132, figs. 7, from Gleanings in Bee Culture*).—In this new frame the ends of the top bars are so constructed and hung as to allow bee spaces all around them. End play is prevented by small staples driven in just below the top bar and striking against the rabbet as the frames hang in position. In such a device the trouble from propolis is reduced to a minimum so that the frames may be handled easily without the aid of a pry.

Some advantages of a bee space, W. C. GATHRIGHT (*Amer. Bee Jour., 37 (1897), No. 36, pp. 562, 563*).—This article is an answer to an article defending the non-use of bee spaces at the ends of frames. A bee space serves a good purpose when one has to handle a large number of bees and time is valuable. Further, in warm weather such spaces are an aid in ventilation.

Injurious insects in Norway, 1896, W. M. SCHÖYEN (*Aarsber. Offent. Foranst. Landbr. Fremme, 1896, pp. 61–116*).—The illustrated report of the State entomologist of Norway for the year 1896.

The ox warble, C. L. MARLATT (*U. S. Dept. Agr., Division of Entomology Circ. 25, 2. ser., pp. 10, figs. 10*).—The author discusses popularly the general characteristics and origin of the ox warble, *Hypoderma lineata*, contrasting it with the warble fly, *Hypodermis bovis*, of Europe. He states that it has been estimated that the damages shown in the depreciation in the value of hides has amounted to as much as $500,000, to which is to be added the depreciation in the quality of beef in infected animals. Miss Ormerod is quoted as authority for the estimate that the warble of Europe causes damages amounting to from £2,000,000 to £7,000,000 per annum. The life history and habits are described somewhat at length and the common remedies, known from the time of Pliny to the present, of smearing strong smelling oils and fats on the animal to prevent the fly from depositing its eggs as well as to kill the larvæ in their final stages noted. The method of removing the grubs by means of tweezers is thought best.

Notes on certain Coleoptera known to attack the Gypsy moth (*Agr. Massachusetts, 1896, pp. 412–433, pls. 3*).—The author discusses the local distribution of Calisoma and Harpalus and the habits of several species of the former genus. The insects were reared in cages and in jars with about 2 in. of earth at the bottom and covered with muslin held in place by rubber bands—a pair of beetles being placed in each jar—and in a box 24 by 5 in. in size sunk in the ground. None of the methods proved thoroughly satisfactory, but eggs were finally obtained from specimens in the jars. From these the author was finally able to learn that the egg stage of *Calisoma frigidum* lasts from 4 to 10 days, the second larval stage from 4 to 11 days, and the third larval stage about 21 days, and that the egg stage in *C. callidum* lasts about 11 days; the first, second, and third larval stages 7, 7, and 30 days, respectively.

The two lined chestnut borer, F. H. CHITTENDEN (*U. S. Dept. Agr., Division of Entomology Circ. 24, 2. ser., pp. 8, fig. 1*).—This is a recompilation of matter relating to *Agrilus bilineatus* that appeared in Bulletin 7, n. ser., of the Division of Entomology (E. S. R., 9, p. 669), with the addition of some new matter. The insect is noted as having been reported from the District of Columbia, Virginia, West Virginia, Illinois, Wisconsin, and Michigan, and as being probably dangerous in parts of Maryland, Pennsylvania, Ohio, Kentucky, North Carolina, and Tennessee. In the District of Columbia the adult insects appear in May and the early part of June and deposit their eggs. *Spathius simillimus* is noted as an undoubted parasite of this borer.

After the borers once attack a tree it is impossible to save it. The methods of extracting the round headed beetle from the tree are in this case scarcely practicable. The chief reliance must be on preventive measures, such as clean culture, cutting down and burning dead or injured trees, the making of trap trees, and coating the trunks with a mixture of clay or manure or with Raupenleim. Storm killed trees should be removed, and sawn timber should not be allowed to season without removing the bark; even the family woodpile may form a nidus for the development of the insects. Wood cut in winter and allowed to season over summer should be disposed of before the following April.

The pear borer, MATSUMARA (*Annot. Zool. Japan, 1 (1897), pp. 1-3, pl. 1; abs. in Jour. Roy. Micros. Soc.* [*London*], *1897, No. 5, p. 379*).—The life history of *Nephopteryx rubrizonella*, the larger pear borer of Japan, is described. This insect destroys from 30 to 50 per cent of the fruit every year. It is a micro-lepidopterous insect of the group Pyradina and of the family Phycidæ.

As remedies, cutting off the branches bearing the eggs, the use of kerosene emulsion, and as a last resort pouring carbon bisulphid into the hole made in the fruit, are mentioned as being employed.

The buffalo tree hopper, C. L. MARLATT (*U. S. Dept. Agr., Division of Entomology Circ. 23, 2. ser., pp. 4, figs. 2*).—A popular description of the buffalo tree hopper (*Ceresa bubalus*), its habits, life history, and damages. Vigorous pruning in the fall and the planting of trap crops are recommended as remedies.

Notes on the life history and habits of certain predaceous heteroptera, A. H. KIRKLAND (*Agr. Massachusetts, 1896, pp. 399-411, pls. 2*).—The life histories of several hemiptera (*Podisus placidus, Dendrocoris humeralis, Diplodus luridus*, and a new species, *Euschistus politus*). A pair of the new species was discovered by the author in Massachusetts, and since then others have been obtained from Rhode Island, Pennsylvania, the District of Columbia, and Maryland. This species does not seem to be common. As an enemy of the gypsy moth this insect is of minor importance, and the author adds that from the structure of its beak he is inclined to believe it is more of a plant feeder than a destroyer of insects.

The suppression of insect pests and plant diseases by legislation, B. T. GALLOWAY (*U. S. Dept. Agr., Proc. Natl. Convention for the Suppression of Insect Pests and Plant Diseases by Legislation, held at Washington, March 5-6, 1897, pp. 31*).—This contains a complete report of the proceedings of the meeting and the text of the bill which has already been referred to (E. S. R., 8, p. 913), as well as a synopsis of papers read at the meeting. In the paper read by L. O. Howard it was shown that the principal places of entry to be guarded are Boston, Charleston, New York, St. Augustine, Key West, Tampa, New Orleans, and Baltimore. A paper by B. F. Delong set forth the plan for inspection, etc., followed in California. This was followed by a paper on "Crop pests and their repression by law" by G. McCarthy, which states that of the 3 classes of farm pests, fungi, weeds, and insects, only the last can be dealt with by national law, and that of such a law a national quarantine, the enforced inspection and certification of plants which are subjects of interstate commerce are the principal desiderata. In the discussion that followed the papers, the difficulty of inspecting fruits put up in boxes, etc., was brought out, but this difficulty it was thought might be overcome by requiring all such goods to be packed in boxes with easily removable covers.

Notes on some chemical points in the preparation of insecticides and fungicides, F. B. GUTHRIE (*Agr. Gaz. New South Wales, 8 (1897), No. 10, pp. 707-715*).—Among the points most worthy of note is that in making Bordeaux mixture the lime water should be poured into the copper solution and not the latter into the former. The lime should be fresh. Free copper sulphate, even in small quantities, burns the foliage and therefore should not be allowed to be present.

The blue stone is sometimes impure owing to the presence of sulphate of iron. Iron vessels should be avoided as containers for this mixture; wooden vessels are preferable.

In making lime, salt, and sulphur wash, the sulphur may be thoroughly incorporated by first grinding it up into a paste with a small quantity of water. The best vessel for boiling the mixture is an enameled one.

Speaking of kerosene emulsion he states that free oil is injurious to foliage and that it attacks India rubber; hence it is necessary to wash out the spraying apparatus with hot water after use.

Spraying fruit trees with Paris green as a remedy against larvæ, W. M. SCHÖYEN (*Ent. Tidskr., 12 (1896), pp. 216–220*).

Insecticides and fungicides, a guide to their application in agriculture and horticulture, W. M. SCHÖYEN (*Insekt- og sopfordrivende Midler. Christiania: Gröndahl & Sön, 1896, pp. 16*).

A simple and cheap apparatus for making kerosene emulsion, W. M. SCHÖYEN (*Norsk Havetidende, 13 (1897), No. 4, pp. 56–58*).

Caution against the use of kerosene in the treatment of Pediculosis capitis, M. E. PAUL (*Lancet [London], 2 (1897), No. 3874, p. 1385*).—The caution is against the danger of fire. A case is cited in which death was brought about not from the hair becoming ignited from a naked light, but, as explained by Lord Kelvin, from an explosive mixture of air and kerosene vapor having been formed in the interstices of the hair which was ignited by an electric spark produced by friction of the hair.

A new application of carbid of calcium, E. CHUARD (*Chron. Agr. Cant. Vaud, 9 (1896), pp. 207–209.*)—The author notes briefly the peculiarities of this substance, its production from acetylene, during the evolution of which the carbid becomes transformed to quicklime and later to slacked lime, if there is sufficient water present. As acetylene has insecticidal properties, he points out that one has in carbid of calcium a substance that may be used as an insecticide and at the same time serve as a mineral manure.

Rörig's lamp for the destruction of insects (*Sci. Amer. Sup. 44 (1897), No. 1135, p. 18145, fig. 1, from La Nature*).—This inexpensive apparatus consists of a hexagonal lantern tapering pyramidally above and below, inclosing a lamp and provided with 6 apertures and as many strong lenses, each preceded with a conical reflector, through which insects attracted by the light may enter. The pyramidal top is provided with ventilators that allow proper ventilation without permitting the escape of the insects. These are attracted below by a saccharine or odoriferous mixture contained in a department in the pyramidal base. At the bottom of this base is a large receptacle into which the insects fall and from which they may be gathered from time to time.

The diameter of the lantern is 0.31 meter; the sides 0.15 meter square. The front aperture is 0.13 meter. The apparatus is supposed to be placed in a field or in a tree.

Foul brood, Pickle brood or new disease, E. S. LOVESY (*Amer. Bee Jour., 37 (1897), No. 27, p. 419*).—A bee disease is noted as occurring in Utah that resembles foul brood sufficiently to be sometimes mistaken for it; but, according to the author, is distinguished from it by a number of peculiarities. It first made its appearance in the spring of 1896 and spread with great rapidity—more so than foul brood—from hive to hive and from one locality to another. There appears to be no doubt that it is contagious. It differs from foul brood in lacking the offensive smell of that disease and in not having the stringy or coffee-colored appearance so characteristic of foul brood. It is strictly a disease of the brood, the larvæ dying when nearly full grown and merely shriveling up. When they reach about the size of house flies they are removed from the cells and cast out of the hive. They may usually be drawn from the cell whole, an impossible thing in foul brood.

According to the author's experience the disease ebbs and flows with the condition of the swarm attacked. A vigorous swarm is seldom attacked. Transferring to a clean hive and foundation acts as a cure, and the same result, it is said, may be obtained by sprinkling bees and comb with fine dried salt. The latter remedy is also recommended for holding foul brood in check.

The real cause of foul brood among bees, W. McEvoy (*Amer. Bee Jour., 37 (1897), No. 23, pp. 356–357*).—The author states that foul brood is a disease caused primarily by the rotting of uncared-for brood and the storing of honey in cells in which such brood has existed. It usually appears in the spring in weak colonies that have spring dwindled so badly that there are not enough bees left to cover or care for all the brood. As a consequence the honey stored in the cells noted becomes mixed with the remains of dead brood and when fed spreads the disease. He further remarks that empty hives will not convey the disease nor do queens transmit it.

Bisulphid of carbon as a foul brood remedy, C. Davenport (*Amer. Bee Jour., 37 (1897), No. 13, p. 195*).—After a number of experiments with drugs for the purpose of determining the best remedy for killing moths in comb honey, the author has come to the conclusion that carbon bisulphid is very efficient, the affected combs being placed in a tight receptacle and being fumigated. The carbon bisulphid has the disadvantage of making the honey thinner and ruining the flavor, but the honey may, nevertheless, be used for the bees. The suggestion is made that the remedy might be used for foul brood. A single experiment is recorded in which foul-broody comb 6 or 7 in. square, containing some honey and about one-third of the comb containing dead brood in different stages, was treated with the fumes of carbon bisulphid over night, or about 10 hours, and then placed on the top of the frames of a colony and mashed so that the honey ran down over the bees and brood, with the result at the time of writing that no foul brood had appeared in the colony. It is pointed out that the method of fumigating would be much more economical than the method of destroying the combs, etc. The remedy seems worthy of being given a more extensive trial.

FOODS—ANIMAL PRODUCTION.

Losses in boiling vegetables, H. Snyder (*U. S. Dept. Agr., Office of Experiment Stations Bul. 43, pp. 7–19, figs. 6*).—Tests were made to determine the losses of nutrients which potatoes, carrots, and cabbages undergo when boiled in a number of different ways, all of which were in accord with household usage. These vegetables were selected as fair representatives of tubers, roots, and salad plants. Analyses of the fresh vegetables are reported. The changes which the different nutrients undergo in cooking are briefly discussed.

The following table shows the average losses which these vegetables undergo when boiled according to the different methods:

Average loss of ingredients in cooking vegetables.

Method of cooking.	Dry matter.	Total nitrogen.	Fat and carbohydrates.	Starch.	Sugar.	Ash.
Potatoes:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Peeled, soaked, and cooked in water cold at start	6.5	51.8	....	....	....	38.3
Peeled and cooked in water cold at start	3.1	15.8	....	1.0	....	18.3
Peeled and cooked in water hot at start	3.4	8.2	....	1.0	....	18.1
Not peeled and cooked in water cold at start	.4	1.0	....	0.1	....	3.4
Not peeled and cooked in water hot at start	.4	1.0	....	0.1	....	3.3
Carrots: *a*						
Cut in small pieces	29.9	42.5	....	....	26.0	47.3
Cut in medium-sized pieces	23.5	27.5	....	....	26.5	37.3
Cut in large pieces	20.2	20.0	....	....	15.5	29.3
Cabbage:						
Cooked in water cold at start	39.3	39.6	38.2	....	....	47.6
Cooked in water hot at start	35.1	35.8	34.3	....	....	40.2

a The carrots were cooked in water both cold and hot at start. The differences were small and only average figures are given.

"The losses which occur in cooking potatoes, carrots, and cabbage vary with the different methods of boiling followed, being quite considerable in some cases. These losses must be taken into account in computing dietaries and made good by adding other materials to supply the nutrients lost. While the loss is not so great as to render it imperative that people in comfortable circumstances should abandon methods of preparing these foods which they consider make them most palatable, there are very large numbers who can not afford to permit even the comparatively small waste of food observed in these experiments.

"The purpose of experiments, such as those here reported, is to learn what actually takes place in the process of preparing food by the common methods. Those having charge of the preparation of food must determine how far it is desirable under individual circumstances to apply the information obtained."

The composition of different parts of the potato and the loss of nutrients during the process of boiling, A. J. FRISBY and A. P. BRYANT (*U. S. Dept. Agr., Office of Experiment Stations Bul. 43, pp. 25–31, fig. 1*).—The structure and composition of potatoes are discussed at some length. Analyses are reported of the outer or true skin of the potato, the inner skin or fibro-vascular layer, the flesh, and the whole potato. These values are given in the following table:

Composition of the whole potato and its different parts.

	Water.	Nitrogen.		Protein.	Fat.	Carbohydrates.		Ash.
		Albuminoid.	Total.			Nitrogen-free extract.	Fiber.	
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Outer, or true, skin	80.1	0.25	0.43	2.7	0.8	14.6		1.8
Inner skin or fibro-vascular layer	83.2	.24	.36	2.3	.1	12.6	0.7	1.1
Flesh	81.1	.18	.32	2.0	.1	15.7	.3	.8
Calculated composition of whole potato	81.3	.19	.32	2.0	.1	15.7		.9

In the authors' opinion 5.5 should be used as the protein factor in calculating the protein content of the potato instead of 6.25. The results obtained by the use of the 2 factors are compared. The losses of nutrients which potatoes undergo when boiled in different ways were also determined. The results were as follows:

The loss of material during the process of cooking potatoes.

	Dry matter.	Nitrogen.			Carbohydrates.	Ash.
		Albuminoid.	Nonalbuminoid.	Total.		
Skins removed before boiling:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Water cold at beginning of test	3.7	4.3	12.9	8.3	2.5	17.0
Water hot at beginning of test	4.0	3.3	17.9	10.0	2.8	17.4
Average	3.9	3.8	15.4	9.2	2.7	17.2
Boiled with skins on:						
Water cold at beginning of test	.3	.6	.6	.6	.2	1.9
Water hot at beginning of test	.3	.4	1.7	1.0	.1	1.2
Average	.3	.5	1.1	.8	.2	1.6

"When potatoes are boiled with the skins removed, there is a very considerable loss not only of organic nutrients but also of mineral salts. These salts, while not nutrients in the sense in which this term is frequently used, are nevertheless important in nutrition. They are of especial value, because of the potassium compounds which they contain, and are apparently necessary for health.

"The greatest actual loss of nutrients seems to be due to the mechanical abrasion of the soft outer portions of the potato while cooking. In this case nearly 3 per cent of the carbohydrates and 4 per cent of the available flesh-forming nitrogenous matter are lost. When the potatoes are boiled with their skins on, the loss of nutrients is very slight, consisting chiefly of nonalbuminoid nitrogenous substances and mineral matter. It is self-evident that if it is desired to boil potatoes with as little loss as possible the skins should be left on."

The digestibility of potatoes and eggs, H. SNYDER (*U. S. Dept. Agr., Office of Experiment Stations Bul. 43, pp. 20–24*).—The digestibility of eggs boiled different lengths of time was determined by digesting with pepsin and hydrochloric acid. A test was made with a man weighing 62.5 kg. to determine the digestibility of potatoes when consumed with eggs, milk, and cream. The experiment lasted 4½ days. The food, urine, and feces were analyzed. The feces were separated by means of charcoal taken in gelatin capsules. The daily diet consisted of 1,587 gm. of potatoes, 8 hard-boiled eggs, 710 cc. of milk, and 237 cc. of cream. It was assumed that 97 per cent of the protein and all of the carbohydrates of the milk, eggs, and cream were digested. The amount of fat in the potatoes was so small that no attempt was made to determine its digestibility. Taking these facts into account, the digestibility of the potatoes was calculated from the digestibility of the total food as actually obtained. The digestibility of the whole diet and of the potatoes is shown in the following table, due correction being made for the fuel value of the nitrogen excreted as urea in the urine:

Coefficients of digestibility of whole food and of potatoes.

	Total organic matter.	Protein.	Fat.	Carbohydrates.	Fuel value.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Whole food	92.7	88.8	93.3	93.8	89.5
Potatoes	90.6	71.9	....	93.0	83.6

The average daily income of nitrogen in the food was 18.14 gm.; the daily excretion was 15.74 gm. in the urine and 2.03 gm. in the feces. Therefore there was a daily gain of 0.37 gm. of nitrogen. This was calculated to be equivalent to 9.88 gm. of protein or 43 gm. of muscle.

The losses and chemical changes which vegetable feeding stuffs undergo when kept for a long time at a high temperature, H. WEISKE (*Landw. Vers. Stat., 48 (1897), No. 6, pp. 379–389*).—A number of samples of medium quality meadow hay were kept in glass jars in a drying oven at 100° for 6 months. Some of the jars were simply covered with filter paper. Twenty-four hours after placing in the oven the contents of a number of the jars were wet with 25 cc. of distilled water. The jars were then stoppered with corks, except one which was closed with a glass stopper. The hay in the latter remained moist longer than that in the others. After 2 weeks or 1 month, and later at intervals of 1 month, samples of the contents of the different jars were analyzed and the digestibility determined by the Stutzer method. The following table shows the composition and digestibility of the nitrogen of samples of hay preserved by the 3 methods:

Composition and digestibility of hay preserved in different ways.

	Protein.	Albuminoid nitrogen.	Fat.	Crude fiber.	Nitrogen-free extract.	Ash.	Digestibility of nitrogen.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Normal hay	12.32	1 86	3.84	22.64	52.46	8.74	1.21
Hay kept at 100° in open jars:							
2 weeks	13.00	....	3.27	21.32	53.70	8.71	.73
1 month	13.75	1.96	1.89	21.21	54.69	8.56	.40
2 months	14.12	....	2.09	20.19	55.35	8.33	.58
3 months	13.19	2.00	1.71	20.17	56.41	8.52	.36
4 months	12.81	....	1.71	18.72	57.92	8.84	.33
5 months	13.29	....	1.59	20.42	56.09	8.61	.31
6 months	13.63	2.03	2.11	18.55	57.06	8.65	.46
Hay moistened and kept at 100° in jars stoppered with cork:							
1 month	13.63	2.03	2.51	18.19	56.50	9.17	.26
2 months	13.37	....	2.03	19.69	56.08	8.83	.28
3 months	13.63	2.00	1.62	17.62	57.53	9.60	.14
4 months	13.69	....	1.67	16.86	58.37	9.41	.19
5 months	14.62	....	1.81	16.77	57.27	9.63	.34
6 months	14.31	1.98	2.07	17.56	56.44	9.62	.25
Hay moistened and kept at 100° in a jar with glass stopper:							
1 month	15.06	....	3.30	14.61	57.41	9.62	.27

Among the conclusions reached are the following: When meadow hay is kept for a long time at 100° there is no marked change in the amount of albuminoid and non-albuminoid nitrogen. On the other hand, the proportion of digestible and indigestible protein is affected. The amount of digestible protein is diminished and the amount of indigestible protein increased even when kept at this temperature only 2 weeks to 1 month. This change was somewhat more marked in the hay which was moistened than in that not moistened. After about 6 months no further change was observed in either sort. That the diminution in the digestibility is due to some deep-seated change in the protein and not to simple coagulation is shown by the fact that when kept at 100° for 4 days the digestibility of protein of the hay was not diminished, though the period was sufficiently long to produce coagulation. It is probable that the digestibility and nutritive value of the other nutrients is also somewhat diminished by keeping hay for a long time at 100°.

The influence of muscular work on metabolism of dogs, N. Zuntz (*Arch. Physiol.* [*Pflüger*], *68, No. 5–7, pp. 191–211*).—A number of experiments are reported with a dog under various conditions of rest and work. The work done was measured by means of apparatus similar to that described in a previous publication.[1] The respiratory quotient, *i. e.*,

[1] Landw. Jahrb., 1889, p. 7.

the ratio of inspired oxygen to respired carbon dioxid, was determined. A tube provided with suitable valves was inserted in the trachea. The dog could breathe only through this tube. The amount of inspired and expired air was measured. The experimental methods followed are reported in detail.

The principal conclusions reached were the following: In normal work all the Mammalia with which experiments have been made have been found to require practically the same amount of chemical energy for the unit of work. A little more than a third of the chemical energy furnished by the food can serve for the production of external muscular work. The rest is transformed into heat. When the work performed consists in pulling, the proportion of the energy of the food which is effective is somewhat less than when the energy is expended in climbing an incline, and the proportion decreases with increased work. The smaller the animal the greater the energy required for forward progression of a like mass through a like distance. The energy expended is very nearly proportional to the surface area of the body.

Contribution to the question of the source of muscular energy, J. Frentzel (*Arch. Physiol.* [*Pflüger*], *68, No. 5-7, pp. 212-221*).—Two experiments were made with dogs. In the first test the food furnished an abundance of fat and protein. During the first few days of the second test the dogs consumed fat only and during the remainder they fasted. The excretion of nitrogen in the urine under various conditions of work and rest was determined. The amount of work performed was measured as in the experiments by Zuntz, noted above (p. 680). The amount of protein which was broken down in the body was computed from the amount of nitrogen excreted in the urine. The energy which this protein would furnish was also calculated. These values were compared with the figures obtained by measuring the energy produced.

The following deductions were drawn: When fat only is consumed or when the subject is fasting, work is performed chiefly at the expense of the fat in the food or fat in the body. Using the data mentioned above, protein could not be regarded as the sole source of muscular energy.

Further investigations on the fat in muscular tissue, E. Bogdanow (*Arch. Physiol.* [*Pflüger*], *68, No. 8-9, pp. 408-430, figs. 3*).—The author has continued the work previously reported,[1] paying special attention to testing the accuracy of the different steps in the method followed in extracting and estimating the fat in meat. Experiments were also made with frogs and rabbits to study the influence of muscular work on the kind and amount of fat contained in the muscles.

The conclusions drawn from earlier work are, in the author's opinion, confirmed, namely, that muscular tissue contains 2 kinds of fat of fairly constant composition, one which may be easily extracted with ether and the other extracted with difficulty. The latter, the so-called plasma fat, has a high percentage of fatty acid. Fat is regarded as the immediate source of muscular energy.

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[1] Arch. Physiol. [Pflüger] 65, p. 81 (E. S. R., 8, p. 713).

Grain rations for fattening sheep, J. H. SHEPPERD (*North Dakota Sta. Bul. 28, pp. 165–175*).—To determine whether it is not more profitable to fatten sheep on inexpensive feeding stuffs available in the local market than to ship them from the range a test was made with 4 lots of range wethers. Lots 1 and 3 consisted of 5 sheep each and lots 2 and 4 of 4 sheep. The test, which began February 9, was divided into 3 periods of 4 weeks each. The periods were separated by several days. Lot 1 was fed oats and timothy hay, lot 2 wheat screenings and timothy hay, lot 3 barley and bran (3 : 1) and timothy hay, and lot 4 barley and bran (3 : 1) and oat straw. The screenings were made up of 33 per cent shrunken wheat, 27.9 per cent wild buckwheat, 11.6 per cent straw, 2.5 per cent oats, 4.2 per cent foxtail, and 20.8 per cent mixed weed seed. For a month before the beginning of the test the sheep had been given a heavy grain ration, and the test proper was preceded by a preliminary period of 10 days on the rations used during the experiment.

The financial statement is based on oats at 25 cts. and barley at 35 cts. per bushel and bran at $10, screenings at $6, timothy hay at $5, and oat straw at $1 per ton.

The cost per pound of gain for the different lots was as follows: Lot 1, 5.96 cts.; lot 2, 5.22 cts.; lot 3, 4.48 cts., and lot 4, 4.93 cts.

A month after the close of the test the sheep were sold for 4½ cts. per pound. On this basis the average profit per head for all the lots was $2.14. The author believes that wheat screenings and bran may be profitably fed to sheep under local conditions.

Among the conclusions drawn from the experiment are the following:

"The best gain was made on a ration of unground oats and timothy hay. A ration consisting of 3 parts barley and 1 part bran, by weight, with timothy hay, made the second best average of 2¼ lbs. per head per week. Oat straw fed as a substitute for timothy hay gave ⅛ lb. less gain per head per week. The lot fed straw ate a much larger proportion of grain to produce a given gain, however, which made the cost per 100 lbs. of gain 45 cts. greater than in the lot fed hay. Sheep fed screenings and timothy hay made the lowest rate of gain, an average of 2 lbs. per head per week. The lot fed screenings required more hay than any other lot which was fed hay. The gain in the lot fed screenings cost 74 cts. per 100 lbs. more than the lot fed barley and bran with hay."

Fodders and feeds (*New Jersey Stas. Rpt. 1896, pp. 122–125*).—Analyses are given of crimson clover, cowpea vines, green rye, rape, corn silage, hay, wheat bran, wheat middlings, dried distillery grains, dried brewers' grains, linseed meal, improved Buffalo gluten feed, Chicago gluten meal, hominy meal, oat feed, nutriotone, and apples.

Average composition of fodders and feeds (*New Jersey Stas. Rpt. 1896, pp. 127–133*).—This includes a compilation of analyses (food and fertilizer constituents) of the more common feeding stuffs.

Market prices of commercial feeds (*New Jersey Stas. Rpt. 1896, pp. 126, 127*).—The cost of a number of feeding stuffs from 1891 to 1896 is given in tabular form.

Feeding stuffs inspection, C. D. WOODS (*Maine Sta. Bul. 37, pp. 8*).—This contains the text of the Maine feeding stuffs law and briefly points out its chief provisions.

On feeding Indian corn to farm animals, F. FRIIS (*Landmansblade, 30 (1897), No. 24, pp. 319–322*).

The length of time which food remains in the digestive apparatus of rabbits, H. WEISKE (*Landw. Vers. Stat., 48 (1897), No. 6, pp. 375–378*).—The author concludes, as the result of a number of experiments, that when rabbits are fed coarse fodder, following a diet of grain, the intestinal tract is probably very free from grain (more or less completely digested) in about 2 days.

Elements of physiology of domestic Mammalia, H. HORNE (*Grundträk af huspattedyrenes fysiologi. Christiania: Gröndahl & Sön, 1897, pp. 100*).

Farm poultry (*Kansas State Bd. Agr. Rpt. 1897, Mar. 31, pp. 256, figs. 33*).—This contains statistics of poultry products sold in the State of Kansas during 1895 and 1896; and articles on breeding, management, and marketing with special reference to local conditions, together with addresses and discussions at the annual meeting of the Kansas State Board of Agriculture, January 13–15, 1897.

A new law of heredity, F. GALTON (*Nature, 56, No. 1445, pp. 235–237*).—An application of the law, given in the author's Natural Inheritances, to a collection of 817 hounds of registered colors, from parents whose colors were known.

DAIRY FARMING—DAIRYING.

Feeding experiment with linseed oil and ground flaxseed on cows, D. MELIK. BEGLARIAN (*Milch Ztg., 26 (1897), No. 33, pp. 522, 523*).—The author refers to Soxhlet's recent work, in which it was claimed that the fat content of milk might be increased by feeding fat (linseed oil, etc.) in digestible form (E. S. R., 8, p. 1016). He reports an experiment made at the farm of the agricultural academy at Poppelsdorf with 4 cows, covering 4 periods of 8 days each. In the first and last periods the ration was the same, consisting of 50 kg. of beets, 14 kg. of hay, 3 kg. of straw, 4 kg. of malt sprouts, 4 kg. of linseed meal, and 2 kg. of barley meal per 1,000 lbs. live weight. In the second period 1 kg. of linseed oil was added per cow daily, being emulsified by treating with water in a cream separator, and in the third period the oil was dropped and 4 kg. of ground flaxseed was fed in place of the linseed meal of the basal ration. Cows 1 and 2 took the linseed oil readily from the first, but cows 3 and 4 had to become accustomed to it. There was a falling off in the appetites of all the cows when the oil was fed, and they refused to eat the basal ration up clean.

The average milk yield and specific gravity and fat content of the milk of each cow for the last 3 days of each period are tabulated. While on linseed oil all the cows shrank in milk yield, and the yield increased when put upon flaxseed. Except in one case the fat content increased on linseed oil, the average increase being 0.23 per cent. It diminished on the flaxseed ration. The author considers there is nothing remarkable in the increase of 0.23 per cent in the second period, as an equal increase frequently occurs in placing cows upon a less favorable ration accompanied by a falling off in milk. The results are considered entirely negative, as the addition of oil was not accompanied by a noticeable increase in fat content, while it acted unfavorably upon the digestion and the general condition of the cows. The flaxseed was equally unsatisfactory.

The question of the relation between the fat in the food and the fat in the milk, M. MAERCKER (*Milch Ztg., 26 (1897), No. 34, pp. 542, 543*).—A short note is given on an experiment in which a ration very poor in fat was fed at first, supplemented later by palm cake and cocoanut cake in separate periods, and later by an especially rich cocoanut cake containing 30.24 per cent of fat. Following this the cows were changed to the ration poor in fat. The results were as follows:

Fat in food and in the milk.

Period.		Fat in the food.	Fat content of milk.
		Kg.	*Per cent.*
1	Ration poor in fat	0.297	3.21
2	Palm-cake ration	.437	3.52
3	Ration poor in fat	.297	3.20
4	Cocoanut-cake ration	.747	3.48
5	Cocoanut-cake ration (very rich in fat)	1.706	4.00
6	Ration poor in fat	.297	3.23

The author believes that the fat content of the milk was materially influenced by the amount of fat in the rations, but states that with the increase in the fat content the yield of milk was unfavorably affected. The yields in the different periods are not given in full, but it is stated that the average yield on the first cocoanut-cake ration was 14.65 kg. of milk, with an average fat content of 3.48 per cent, and that in the following period, when the richer cocoanut cake was fed, the yield sank to 12.42 kg., with an average fat content of 4 per cent. There was no advantage from feeding the richer ration, as the increase in fat content was not sufficient to overcome the decrease in yield. The rations rich in fat had a marked effect on the increase in live weight of the cows.

Experiments in milking twice and four times daily, BACKHAUS (*Königsberger Land- u. Forstw. Ztg.; abs. in Milch Ztg., 26 (1897), No. 41, p. 654*).—A short experiment is reported with 8 cows, the results of which are summarized below.

Comparison of milking twice and four times a day.

	Total yield of 8 cows.			Average composition of milk.	
	Milk.	Fat.	Solids-not-fat.	Fat.	Solids-not-fat.
				Per cent.	*Per cent.*
Cows milked twice a day (June 21–24)	524.60	17.04	45.47	3.25	8.67
Cows milked 4 times a day (June 28–31)	576.70	17.95	49.57	3.11	8.60
Percentage increase from milking 4 times a day	9.93	5.34	9.01		

Milking 4 times a day gave a larger yield of both milk and fat than milking twice a day. Contrary to the usual rule, milking 4 times a day gave the poorer milk. To test this further the experiment with milking 4 times a day was continued, the cows receiving a richer ration. On an average the 8 cows showed an increase of 5.36 per cent in the yield of fat, but only 0.44 per cent increase in the yield of milk and 0.65 per cent in the yield of solids-not-fat over milking twice a day. It was found further that when the time between milkings was divided equally the milk did not have the same composition, the milk being poorer in fat after the cows had been at rest, as at night, while after they had been in active motion, feeding, etc., the fat was higher. This is said to agree with the results obtained when cows are worked.

Proportion of ash and phosphates in cows' milk, L. VAUDIN (*Ann. Chim. Analyt. et Appl., 2 (1897), pp. 344–347; abs. in Analyst, 22 (1897), Nov., p. 282*).—From analyses of the milk of several different breeds of cows fed on a variety of fodder, the author concludes that in normal milk the percentage of ash ranges within the limits of 7 and 8 gm. per liter, of which 3.3 to 4 gm. consists of phosphates (lime, magnesia, and iron) precipitable by ammonia. This is independent of breed, soil, daily yield, etc., but the individuality of the animal and the diet exercise a slight influence on the proportions between the above limits. On the other hand, in milk rendered abnormal by pathological or other influences, the percentage of ash and proteid bodies is increased, but in an irregular manner. For example, in the case of a pregnant cow the milk contained 52.16 per cent of albuminoids and 8.6 per cent of ash, and that from one poisoned by oil cake infested with Aspergillus, 44 and 8.5 per cent, respectively; whereas in two instances the albuminoids of normal milk amounted to only 36.3 and 41.6 per cent.

Concerning the phosphorus in human milk and cows' milk, J. STOKLASA (*Ztschr. Physiol. Chem., 23 (1897), No. 4–5, pp. 343–346*).—The author finds that aside from the phosphorus in the casein and nuclein, milk contains considerable phosphorus in the lecithin. He finds the lecithin content of milk higher than previously reported. The range per liter is 0.90 to 1.13 gm. for cows' milk, and 1.1 to 1.3 gm. for human milk. Analyses showed human milk to contain 0.44 gm. of phosphoric acid (as P_2O_5) per liter and cows' milk 1.81 gm. Accordingly it is calculated that human milk contains per liter 0.153 gm. of P_2O_5 as lecithin, while cows' milk contains only 0.091 gm., these amounts representing 35 per cent of the total P_2O_5 in human milk and 5 per cent of that in cows' milk.

Siegfried gave the nuclein content per liter as from 0.55 to 0.6 gm. for cows' milk, and from 1.1 to 1.3 gm. for human milk.

The author calls attention to the analogy between milk and the embryo of the seeds of some plants with respect to the form of the organic phosphorus.

Composition of the milk of Oldenburg breeding mares, P. PETERSEN and H. HÖFKER (*Milch Ztg., 26 (1897), No. 41, pp. 647, 648*).—The authors made analyses of the milk of 3 mares at different dates after foaling. The maximum, minimum, and average composition of the 10 samples analyzed is given in the following table:

Composition of mares' milk.

	Specific gravity.	Water.	Total solids.	Fat.	Nitrogenous matter.	Milk sugar.	Ash.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Maximum	1.0405	90.60	10.43	1.07	2.63	7.12	0.48
Minimum	1.0334	89.57	9.40	.37	1.56	6.34	.27
Average	1.0363	90.18	9.82	.61	2.14	6.73	.35

It is pointed out that mares' milk in comparison with cows' milk is much richer in water and sugar but poorer in fat, nitrogenous matter, and ash. The fat in the analyses given is said to be lower than has usually been found for mares' milk but higher in sugar. It is suggested that this may possibly be due to the fact that the animals were at pasture. In substituting cows' milk for mares' milk in feeding colts the usual recommendation to dilute with water and add sugar is believed to be questionable. It is believed to be better not to add any sugar, but to dilute the milk about one-half at first and about one-third later. It is shown that as the period of lactation advances the percentage of both nitrogenous substance and salts decreases while the sugar increases.

Milk: Composition, nature, hygienic and economic methods of handling, A. J. McClatchie (*Southern California Acad. Sci. Agl. Expt. Section Bul. 3, pp. 29*).—This is a popular bulletin, with the results of some experimental work.

Analyses are given of samples of milk from 8 dairies, together with a record of tests of milk delivered in Los Angeles during the months of June, July, and August. Numerous experiments are briefly reported showing the large number of bacteria in the milk from the first part of the milking ("fore milk"), the bacteria which fall from the cow during milking, the number of bacteria in the air of stables, the bacteria in dairy utensils, the reduction of bacteria in milk by careful milking and handling, the effect of high and low temperatures, cases of gaseous fermentation of milk, bitter milk, and ropy milk. A case of bitter milk was entirely remedied by painting the room in which the milk and cream were kept and observing more cleanly methods. A bad case of ropy or stringy milk was investigated. The condition of the stables, the dairy utensils, and the clothing of the milkers was found to be bad.

"While milk drawn in the ordinary way into unsterilized vessels invariably became ropy, in no case did ropiness ensue when the milk was drawn from these same cows with precautions that prevented the entrance of many living bacteria. Even cleansing the teats and udder with plain water and milking into a sterilized pail covered with cloth to exclude dust prevented ropiness."

The ropiness was communicated to other milk by adding a little of the infected milk. It was found that the milk from some of the cows had a greater tendency to become ropy than that from others, and experiments indicated "that the exterior of some of the cows was infected with the bacteria causing trouble more than the others; and that even the canals of the teats of one cow were infected, as indicated by the fact that her milk became ropy though the exterior had been carefully cleansed. The other 23 cows were tested and the milk from none of them became ropy when drawn with antiseptic precautions." The cause of the trouble, although apparent to the author, was not removed on account of a lack of appreciation of the importance of cleanliness and the failure on the part of the proprietors to fully cooperate with the author.

In conclusion the milk ordinance of the city of Los Angeles is given.

Milk: Its decomposition and preservation, R. R. DINWIDDIE (*Arkansas Sta. Bul. 45, pp. 49–77, pls. 3, figs. 3*).—The first part of the bulletin has to do with the spontaneous changes occurring in milk, the sources of bacterial infection, and methods of preserving milk. Some data are given as to the number of bacteria in milk, based on observations by the author, accompanied by a popular discussion of the subject of milk fermentations, the control of the souring of milk, methods of sterilizing, etc.

The second part reports some investigations on the species of bacteria more commonly concerned in the souring of milk in the locality. The milk from 2 dairy farms in the vicinity of the station was examined from October to March and 2 samples of milk were obtained from dairies in other parts of the State. The bacteria found in the souring milk were classed under 3 heads: (1) those which occasioned a rapid souring and complete coagulation, (2) those which produced only a partial curdling with or without acidity, and (3) those which multiplied in the milk without curdling either with or without acidity. Two representatives of the first group are illustrated and described. For one of these, which the author believes to be a hitherto undescribed species, he proposes the name *Bacterium lactarii*. Its characteristics are described in detail.

Experiments with pure cultures for ripening cream, P. VIETH (*Milch Ztg., 26 (1897), No. 33, pp. 519–521*).—The author reports a number of experiments made at different seasons of the year with Witte's and von Lorentz's cultures. Control experiments were also made. The butter was kept for two or three months and then tested as to quality. In general the butter made with the Witte cultures was better than that made without, as it changed less in keeping. The von Lorentz cultures had no apparent good effect on the butter as compared with no cultures.

The author concludes that in these experiments, as in his previous experiments, there was in general no unmistakable and universal improvement in the quality or the keeping properties of butter from using pure cultures. He states it as the general opinion of creameries that pure cultures materially improve the quality of the butter, but mentions that they are employed in creameries especially when some butter fault appears. He believes that pure cultures are chiefly of value in cases of butter faults, and intimates that the difficulty might frequently be avoided or remedied by scrupulous cleanliness and employment of low temperatures.

Action of beer yeasts on milk, E. BOULLANGER (*Ann. Inst. Pasteur, 11 (1897), p. 720; abs. in Chem. Ztg., 21 (1897), No. 89, Repert., p. 257*).—There has been some difference of opinion as to whether yeasts in some cases act upon not only the milk sugar but the casein of milk also. The effect was studied of 8 different beer yeasts on sterilized milk. During the first 3 months the appearance of the flasks was about the same, after which a gradual change became apparent. After 14 months the experiment was discontinued and microscopical and chemical examinations made of the contents of the flasks. It was found that the different kinds of yeasts acted upon the casein in the same relative proportion that they were able to liquefy gelatin. In some cases the casein was dissolved but not further changed, and in others it was more or less decomposed.

Annual report of the chemist, W. C. ROBINSON, Jr. (*Annual Report of the Chief Inspector of Milk and of the Chemist of the Board of Health of the City and Port of Philadelphia, 1896, pp. 24–59*).—This contains a discussion of the detection of the addition of water to milk, methods of milk analysis, test for coloring matter and preservatives in milk, a discussion of butter and margarin and other food products, and analyses of a large number of samples of water.

Two samples of human milk were analyzed with the following results:

Analyses of human milk.

	No. 1,268.	No. 1,509.
	Per cent.	*Per cent.*
Total solids	12.72	11.83
Fat	5.58	3.30
Milk sugar	6.10	5.80
Albuminoids	1.04	2.73
Mineral matter	.11	.23

"The former was probably drawn from the glands when nearly empty, and the latter when full."

A sample of goat's milk had the following composition:

Analysis of goat's milk.

	Per cent.
Total solids	16.33
Fat	5.85
Albuminoids	4.49
Milk sugar	5.11
Mineral matter	.88

"A very rich milk."

Cost and composition of milk in cities in New Jersey (*New Jersey Stas. Rpt. 1896, pp. 134–157*).—This is practically a reprint from U. S. Dept. Agr., Office of Experiment Stations Bulletin 35 (E. S. R., 9, p. 80).

Comparison of the yields and economy of the Ayrshire and native (Telemark) breeds of cattle at Aas Agricultural College, 1860–1896, H. ISAACHSON (*Ber. Höiere Landbr. Skole i Aas, 1895–'96, pp. 43–94*).

The results of crossing between the Allgan and the Norrland mountain breeds, J. BRUN (*K. Landw. Akad. Handl. Tidskr., 36 (1897), No. 3, pp. 198–201*).—The average yield of milk for 6 years (1888–'93) for a herd of 22 cows was 2,421.1 liters. No analyses of the milk produced are given.

On the feeding of milch cows, H. NATHORST (*Tidskr. Landtmän, 18 (1897), Nos. 21, pp. 367–371; 22, pp. 385–388*).

Does Wolff's standard ration for milch cows fill the demands of a modern and scientifically exact standard? E. O. ARENANDER (*Tidskr. Landtmän, 18 (1897), Nos. 9–14, pp. 145 et seq.*).—Answered in the negative.

Are Wolff's feeding standards antiquated? H. NATHORST (*Tidskr. Landtmän, 18 (1897), No. 19, pp. 331, 337*).—Reply to E. O. Arenander's articles in previous numbers of the Tidskrift.

Modern fodder tables and feeding standards for milch cows with different milk yields, E. O. ARENANDER (*Tidsenliga fodertabeller jämte Utfordringsnormer för mjölkande kor. Stockholm, 1897, pp. 28; extracts in Landtmannen, 8 (1897), Nos. 7, pp. 89–94; 8, pp. 103–107*).

Reindeer moss as food for milch cows, B. TORSSELL (*Landtmannen, 8 (1897), No. 35, pp. 494–496*).

Methods of milk testing, R. GRIPENBERG (*Tidskr. Mjölkhushåll., 6 (1897), Nos. 24, pp. 93, 94; 26, pp. 101, 102*).

On the titration of sour cream, R. GRIPENBERG (*Tidskr. Mjölkhushåll., 6 (1897), No. 19, pp. 73, 74*).

A land flowing with milk and butter—the truth about Danish dairying, D. YOUNG (*Edinburgh: C. & R. Anderson, 1897, pp. 30, figs. 9*).—Reprinted from *North British Agriculturist*.

On the making of taette-melk (stringy milk) (*Norsk Landmansblad, 16 (1897), No. 28, pp. 313, 314*).

Progress in the chemistry, hygiene, and bacteriology of milk and its products, H. BURSTERT and F. J. HERZ (*Chem. Ztg., 21 (1897), No. 97, pp. 1012–1017*).—This is a quite extensive review of work in dairying during the past two years.

Microorganisms in dairying, N. BENDIXEN (*Mikroorganismer i Mælkeribruget. Copenhagen: H. Hagerup, 1897, pp. 61*).—Swedish translation in *Nord. Mejeri Tidn., 12 (1897), No. 9–16, pp. 101 et seq.*

Pasteurization and pure cultures in butter making, N. ENGSTRÖM (*Tidskr. Landtmän, 18 (1897), No. 33, pp. 587–594; Nord. Mejeri Tidn., 12 (1897), No. 35, pp. 411–413*).

On the question of the occurrence of tubercle bacilli in market butter, LYDIA RABINOWITSCH (*Ztschr. Hyg., 26 (1897), p. 90; abs. in Chem. Ztg., 21 (1897), No. 91, p. 272*).—The author has examined 80 samples of butter in Berlin and Philadelphia, but has not found a single case where true tubercle bacilli were present, although microorganisms closely resembling them were often found, which could only be distinguished from them by culture and pathogenic experiments.

Some experiments with the pasteurization apparatus Triumph, R. GRIPENBERG (*Tidskr. Mjölkhushåll., 6 (1897), Nos. 15, pp. 57, 58; 16, pp. 61, 62; Nord. Mejeri Tidn., 12 (1897), pp. 256, 257; Biet [Helsingfors], 18 (1897), No. 3, pp. 79–84*).

Should the coloring of artificial butter be prohibited by law? F. H. WERENSKIOLD (*Norsk Landmansblad, 16 (1897), No. 22, pp. 249–251*).

Swedish butter exhibitions (*Nord. Mejeri Tidn., 12 (1897), No. 37, pp. 435–437*).

Report of the periodical butter exhibitions in Hango (Finland), 1896–'97 (*Helsingfors, 1897, pp. 46*).—Eight exhibitions, in all essentials similar to the Danish periodical butter exhibitions (E. S. R., 5, p. 721; 7, p. 626), were held during the year under the direction of the Finnish Agricultural Department (*Landtbruksstyrelsen*).

Pure cultures in cheese making, O. JOHAN-OLSEN (*Aarsber. Offent. Foranst. Landbr. Fremme, 1896, pp. 478–489; Nord. Mejeri Tidn., 12 (1897), No. 31, pp. 365, 366*).

The principles of cheese making, as viewed from a bacteriological standpoint, G. GROTENFELT (*Tidskr. Mjölkhushåll., 6 (1897), Nos. 14–28, pp. 53 et seq.; Nord. Mejeri Tidn., 12 (1897), Nos. 19–29, pp. 220 et seq.*).

The manufacture of Edam and Gouda cheeses, N. HÖRLYCK (*Norsk Landmansblad, 16 (1897), No. 27, pp. 306–309*).

Swedish "estate-cheese" (herrgårdsost) and Gouda cheese, G. LILJHAGEN (*Nord. Mejeri Tidn., 12 (1897), Nos. 16, pp. 183, 184; 17, pp. 195–197*).

Milk and its products, H. H. WING (*New York: The Macmillan Co., 1897, pp. 230, figs. 33*).—This is "a treatise upon the nature and qualities of dairy milk and the manufacture of butter and cheese," designed to give "to the dairymen and particularly to the dairy student in simple, concise form, the principles underlying modern dairy practice." The object of the author has been admirably fulfilled. The pressing need of a text-book on dairying, suited to use in the class room and for general reading, has been met in a most acceptable manner. Both the scientific and the practical sides of dairying are treated in a popular, concise, and clear style, and the information given is brought well up to date. Beginning with the secretion and the composition of milk, the testing of milk, ferments and fermentations and their control, market milk, and the different stages of butter making and cheese making are treated in logical order, followed by the utilization of by-products of the dairy, butter and cheese factories, and dairy statistics. An appendix contains various useful rules and tests, laws of various States affecting dairy products, and a bibliography of dairy work at the experiment stations. A comprehensive index completes the volume.

Testing milk and its products, E. H. FARRINGTON and F. W. WOLL (*Madison, Wis.: Mendota Book Co., 1897, pp. 236, figs. 45, pl. 1*).—This little book treats not only of the testing of milk but the application of the results on the farm and at the creamery and cheese factory. It is intended as "a manual for dairy students, creamery and cheese-factory operators, and dairy farmers." The method of treatment of the subject is very complete and the style is simple and plain. The introduction shows the evolution of the milk test, describing the various tests proposed in this country and abroad. The opening chapter is on the composition of milk and its products, and this is followed, after a chapter on sampling, by a description of the Babcock test, method of making the test, modifications, apparatus, calibration, etc., and descriptions of various forms of the test on the market. The lactometer and its application, testing the acidity of milk and cream, and testing the purity of milk are next treated; followed by chapters on the application of the milk test on the farm in improving the herd, composite sampling, cream testing at cream-gathering creameries, calculation of the butter and cheese yields from the results of test, and the calculation of dividends at creameries and cheese factories. The final chapter is on the methods of chemical analysis of milk and its products. An appendix gives various useful tables to facilitate calculations, and suggestions regarding the organization of coöperative creameries and cheese factories; and is followed by a good index. The book is the most complete treatise on the subject of milk testing in a broad sense yet published, and should prove a very useful handbook.

VETERINARY SCIENCE AND PRACTICE.

Report of the biologist, J. NELSON (*New Jersey Stas. Rpt. 1896, pp. 235–285*).—Observations were made on the temperature fluctuations of cows, and a series of temperature experiments begun in 1894 were completed; studies were begun on the curative effect of repeated injections of tuberculin, and on the germ content of milk.

Experimental work (pp. 236–262).—In a general way, the effect of repeated injections of tuberculin is discussed, and the fact noted by Bang that different animals react differently and that the same animal at different times reacts very irregularly is brought out and shown to need further study. Some animals react when no tuberculosis can be found; some react only after a number of injections, others repeatedly, and still others upon the first and third injection but not upon the second. The lack of reaction or of a lowered reaction is considered a doubtful indication of a curative process from the fact that badly affected cows often give no response to the test.

As to the curative effect of tuberculin, the author concludes that the effect is exercised in a very desultory manner. Sometimes it appears to cure, sometimes to retard the disease, and in others to hasten it. Illustrative of this last fact, the case is cited of a cow that began to show signs of failing health and after the ninth test was slaughtered and found more or less badly infected in nearly all the organs. In another instance a cow that had received 12 injections appeared at the time of writing none the worse.

Relative to the germ content of milk, the fact is brought out that the udder is not always affected. even in badly tuberculous animals; nor are the four teats affected in the same degree. It is thought very likely that a few germs may remain in the milk ducts after milking and multiply greatly during the next 12 hours. This would account for the fact that they are in greatest abundance in the first spurts drawn. The greatest average number of germs per drop found in the tests was 649, the lowest 18. In the former case germs were found in great numbers in milk from each of the teats and in every spurt. In the other cases noted, their occurrence in relation to the number of the spurt and to the teat was more or less irregular. The number of germs to the spurt and the relation of this number to the number of the spurt in the series of spurts is well shown by the following table, teat B and C representing the two hind teats:

Number of germs per drop of the milk of cow 26.

Number of spurt.	Teat B.			Teat C.		
	Amount in each spurt.	Total amount in spurts drawn.	Number of germs per drop.	Amount in each spurt.	Total amount in spurts drawn.	Number of germs per drop.
	Cc.	*Cc.*		*Cc.*	*Cc.*	
One	5	5	10, 540	2	2	11, 900
Three	8	18	4, 420	3	9	2, 040
Five	10	36	2, 380	3	14	1, 530
Seven	6	49	1. 360	2	20	1, 140
Nine	9	65	2, 550	4	27	930
Eleven	9	85	480	5	36	740
Thirteen	8	103	220	2	43	720
Fifteen	5	114	520	3	50	940
Seventeen	11	138	440	4	58	1. 240
Nineteen	7	155	330	4	65	620

The suppression and prevention of tuberculosis of cattle and its relation to human consumption (pp. 263–285).—This is a general discussion of the subject. The death rate from the disease, both human and bovine, as shown by statistics from various countries is given, as well as a discussion of what constitutes tuberculosis, its cause, degrees. symptoms; milk as a carrier of the germs, the tuberculin test, and an account of Bang's method.

Laboratory tests of creolin as a disinfectant, F. S. ROOP (*Virginia Sta. Bul. 63, pp. 47–52*).—In the experiments with this oily coal tar product, *Staphylococcus pyogenes aureus*—the virulence of which had been tested by its producing death in a rabbit in 24 hours—suspended in water was exposed for varying lengths of time to emulsions of creolin of 2, 1½, 1, and ½ per cent strengths.

Where the 2 per cent emulsion was used, the tabulated results show but one case where a colony grew. This was after the 15 seconds exposure. Where the 1½ per cent emulsion was employed 3 such colonies were found, but only 1 was found in the case of the 1 per cent emulsion. Where the emulsion was of ½ per cent strength, 5 such colonies appeared after each were in the same dish. But in all the series where the time of exposure was 5 minutes or more not a single colony developed. From the laboratory experiment the author concludes that creolin is a true disinfectant, and that most favorable results are to be expected where the germs are few and the temperature comparatively high. To test the effect of creolin on the tissues, the author kept one hand immersed in undiluted creolin for 5 minutes, with the result that on the following day there was scarcely any perceptible effect. The small cost of the substance as well as its effectiveness makes creolin one of the best disinfectants and antiseptics for general use.

The function of the white blood corpuscles, F. FRIEDENTHAL (*Biol. Centbl., 17 (1897) No. 19, pp. 705–718*).—The author reviews the literature relative to the subject, and gathering up the threads of his argument concludes that the white blood corpuscles serve an important rôle in the coagulation of the blood in the body, as scavengers in disease, attacking and removing foreign bodies, large and small. In animals with metamorphoses they aid in breaking down the old and building up the new tissues.

An epidemic of botulism, DINEUR (*Bul. Soc. Belge. Micros., 23 (1897), No. 4–6, pp. 45–66*).—It is recorded that on December 5, 1896, there occurred at Antwerp an epidemic of botulism which attacked 76 out of 153 men, 19 of whom were taken to a hospital. Medical inquiry brought out the fact that the men had eaten sausages. The meat of the sausages was superficially examined, and as usual in cases of meat poisoning no apparent evidence of anything deleterious found. A chemical examination brought to light a ptomaine, but in quantities too small to be followed by noticeable results when injected into animals. Injections of fragments of the sausage into a mouse, however, produced death, and an inoculation of another mouse with cultures made from the blood of the first resulted similarly, the animal dying at the end of 22 hours. A microscopic examination of the sausage brought to light numbers of a coli bacillus. A brief historical résumé of the subject of botulism is given. In concluding, the author says, besides what has already been mentioned, that it appears that the animal, the flesh of which had been used in making the sausage, must have been in a bad state of nutrition, but whether this state was of a morbid nature, toxic or otherwise, is undeterminable. The evil effects that followed eating the sausages it was found could be avoided by heating the sausages to a temperature of 100° C. for 5 minutes.

Agglutination of bacillus typhosus by chemical substances, E. MALVOZ (*Ann. Inst. Pasteur, 11 (1897), No. 7, pp. 582–590*).—From the author's experiments, it appears that agglutination of this bacillus may be produced by formalin, corrosive sublimate, oxygenated water, and alcohol, when used on cultures. The concentration of the substances is an important matter with these substances, but with safranin and vesuvin only very dilute solutions are necessary, 1 per 1,000 being sufficient. A slight agglutinating action may be obtained with salicylic acid and permanganate of potash, while caustic soda and ammonia mixed with hard water have a strong agglutinating action, but not when mixed with distilled water. The action of these chemical substances was used by the author for the purpose of distinguishing the typhoid bacillus from *Bacillus coli communis*. Formalin was used. In the typhoid cultures the bacilli were agglutinated into clumps while the coli bacilli were immobilized and isolated. From experiments made after washing off the outer layers of the bacteria, it appears that the agglutination phenomena are confined to the ciliated envelope.

Some parasitical diseases of sheep, E. A. SMYTH and E. P. NILES (*Virginia Sta. Bul. 64, pp. 55–65*).—There are here described in a popular manner several intestinal worms (*Strongylus contortus, Œsophagostomum columbianum, Tænia expansa, T. cœneurus* (gid), *T. echinococcus*), and the diseases produced by them. Treatment, it is thought, should preferably be precautionary, since in late stages of the disease it is of little value. Curtis is followed in recommending turpentine with an addition of six parts of milk. There is also recommended the following mixture, which the author has used with good results: Powdered areca root, 3 drams; powdered artemisia, $1\frac{1}{2}$ drams; sodium bicarbonate, 6 drams. This mixture is to be divided into 3 powders and 1 given to each sheep 10 or 12 hours apart. If given in late winter and early spring when the larvæ of *Œsophagostomum columbianum* are emerging from their nodules, and the treatment continued at intervals of once or twice a month and the sheep changed from time to time to fresh pastures, the worm may be entirely removed from a field in the course of a year or so.

The remedy regarded most effectual for tapeworms, which are more difficult subjects to deal with, is areca nut powdered 2 drams, and powdered male fern 1 oz., all to be given at one dose.

Staphylococcus hæmorrhagicus, E. KLEIN (*Brit. Med. Jour., 1897, No. 2, pp. 385–387; abs. in Jour. Roy. Micros. Soc.* [*London*], *1897, No. 5, p. 429*).—A coccus isolated from a vascular eruption on the hands of persons who had been skinning sheep that had died of gargle a few days after lambing, is described as pathogenic to man and animals. It belongs to the same group as *Staphylococcus pyogenes aureus*, is 0.4 to 0.6 μ in diameter, and grows freely on ordinary media. Gelatin is slowly liquefied by it and milk coagulated in about a week. Alkaline broth is rendered turbid and an acid reaction given in from 2 to 4 days. A whitish growth is produced on agar and gelatin, which becomes yellow with age and increases the size. Cultures were virulent to guinea pigs and sheep and produced chiefly a hæmorrhagic œdema of the subcutaneous and muscular tissue and sanguinolent fluid in the peritoneal sac. On the other hand, inoculations of the agar culture that had proved fatal to sheep gave positive results.

Diseases of sheep, T. D. HINEBAUCH (*North Dakota Sta. Bul. 28, pp. 176–184*).—A reprint of Bulletin 3 of the station (E. S. R., 3, p. 619).

Pseudo-tuberculosis hominis streptotricha, S. FLEXNER (*Bul. Johns Hopkins Hospital, 18* (*1897*), *pp. 128, 129; abs. in Jour. Roy. Micros. Soc.* [*London*], *1897, No. 5, p. 430*).—In the lungs of a negro who died with symptoms of tuberculosis was found a fungus, branching, often occurring in clumps, or in convoluted masses. No microbes resembling *Bacillus tuberculosis* were found. On account of the lesions in the lungs and peritoneum and of the intimate relation of the streptothrix to the pathological processes and also on account of the symptoms resembling *Phthisis florida*, the organism was given the name *Pseudo-tuberculosis hominis streptotricha.*

European government measures for the eradication of tuberculosis in farm animals (*Landtmannen, 8* (*1897*), *Nos. 12, pp. 159–164; 13, pp. 180–185; 20, pp. 278, 279.*)

Measures against bovine tuberculosis in Sweden (*Landtmannen, 8* (*1897*), *No. 34, pp. 480, 481*).

Septicemia of calves, THOMASSEN (*Ann. Inst. Pasteur, 11* (*1897*), *pp. 523–540; abst. in Jour. Roy. Micros. Soc.* [*London*], *1897, No. 5, p. 427*).—A new disease of calves which is associated with nephritis and urocystitis. It has a duration of 5 or 6 days and besides parenchymatous nephritis and cystitis is accompanied by an enlargement of the spleen. A bacillus resembling in appearance the bacillus of typhoid or *Bacillus coli communis* was isolated from the blood, peritoneal fluid, and various organs. From *Bacilli coli communis* it is to be distinguished by its moist-looking growth on potato, its slow growth on gelatin, its great nobility, by its inability to ferment lactose and to coagulate milk, and by its producing little or no indol or carbonic acid, as well as by the absence of any disagreeable odor from peptone bouillon or from gelatin cultures. Its serum reaction distinguishes it from the typhoid germ. The agglutination of fat is much less strongly marked and of a different character.

Plague bacillus, M. OGATA (*Centbl. Bakt. u. Par., 1. Abt., 21 (1897), pp. 769–777; abs. in Jour. Roy. Micros. Soc. [London], 1897, No. 5, pp. 426, 427*).—As a result of the author's observations made on plague patients in Formosa, it appears that an organism is constantly found in plague corpses in the lymphatic glands of plague patients which reproduces in animals a disease very closely resembling the plague. The presence of the plague bacillus is not constant in the blood of the plague patients. It may be found in the urine and bile of plague corpses; it may be transported by the flea and mosquito; it is constantly found in the blood and viscera of rats, naturally or artificially infected with the plague, and fleas feeding upon such rats often contain virulent bacilli. In patients other bacilli may be also present. It is but little resistent to antiseptics.

Preventive vaccination against blackleg, D. E. SALMON (*U. S. Dept. Agr., Bureau of Animal Industry Circ. 20, pp. 2*).

Directions for the use of blackleg vaccine, D. E. SALMON (*U. S. Dept. Agr., Bureau of Animal Industry Circ. 21, pp. 8, figs. 2*).—The method of preparing the vaccine in the laboratory of this Bureau is described, as well as the method of using it, noting in the latter case what animals are to be vaccinated and the size of the dose to be injected. A reprint of Circular 20 of the Bureau is appended.

Micrococcus ghadiallii, GHADIALLY (*Brit. Med. Jour., 1897, No. 2, pp. 418–419; abs. in Jour. Roy. Micros. Soc. [London], 1897, No. 2, p. 428*).—The author has discovered a coccus which has the power of slowly destroying the microbe of enteric fever in water and milk and also to a slight extent in bouillon. *Bacillus coli communis* in water also seems to be destroyed by it. In the experiments the enteric microbes were acclimatized before inoculation with the micrococcus.

The fate of the tetanus toxin, A. MARIE (*Ann. Inst. Pasteur, 11 (1897), pp. 591–599*).—The fact that a tetanus toxin injected into a vein requires a dose 7 to 8 times greater to kill the animal than if injected under the skin the author explains by stating that this toxin is easily and effectively carried to the central nervous system along nerve paths. In the circulation the plasma of the blood and the blood cells very materially alter the poison. It may remain in the blood for some time.

Aspergillus fumigatus on domestic animals, etc., A. LUCET (*De l'Aspergillus fumigatus chez les animaux domestiques et dans les œufs en incubation. Paris: Mendel, 1897, pp. 108, pls. 14*).

Resorption of bacteria after local infection, J. HALBAN (*Sitzber. Math. Naturw. Cl. Akad. Wiss. [Vienna], 105 (1896), pp. 349–452, pls. 2*).—From experiments the author is able to say that the time required for different species of bacteria to reach the nearest lymphatic glands from the spot of inoculation varies with the bactericidal power of the alexin, being slower when that power is strong and quicker when it is weak. The time required to reach the blood is very variable. It was ascertained that an infection of a bleeding wound may remain local for about $2\frac{1}{2}$ hours in the case of anthrax.

Excretion of bacteria by the animal body, F. J. COTTON (*Sitzber. Math. Naturw. Cl. Akad. Wiss. [Vienna], 105 (1896), pp. 453–512; abs. Jour. Roy. Micros. Soc. [London], 1897, No. 5, p. 426*).—Employing rabbits, the author made a series of experiments to ascertain the conditions under which and the time and in what quantity bacteria are excreted in the bile and in the intestine after intravenous injection. *Bacillus anthracis*, *B. subtilis*, *B. prodigiosus*, *B. pneumoniæ*, *Staphylococcus aureus*, and *Diplococcus pneumoniæ* were employed. From the results it is concluded that certain bacteria when present in large numbers in the blood may be excreted by the bile without perceptible changes taking place in the liver or bile ducts, but that almost necessarily large numbers of bacteria in the bile is associated with pathological changes.

Further, the presence of bacteria in the intestine and in the urine is almost certain evidence of pathological changes in the urinary tract or intestine.

Empiricism or science: Anæsthetics, 1847 to 1897, D. W. Buxton (*Lancet [London], 2 (1897), No. 3874, pp. 1369–1376*).—A lecture delivered before the Society of Anæsthetists, November 18, 1897. It deals almost wholly with chloroform, the history of its use, its action, and the explanations that have been offered for the latter. It is stated that it can not be said that mortality as a whole has decreased since the beginning of the use of chloroform. Fewer mistakes would be made if only experienced persons were called upon to use the anæsthetic. Experienced men will use with safety the rudest means with impunity; but to allow the inexperienced to use such means is to court disaster.

TECHNOLOGY.

The sweet potato as a starch producer, F. S. Shiver (*South Carolina Sta. Bul. 28, pp. 15*).—Analyses of 4 samples of sweet potatoes made in the spring of 1894 showed the water content to range from 55.93 to 67.62 per cent, and the starch from 16.93 to 29.58 per cent. Analyses are given of 3 samples of sweet potatoes sent to the station and of 7 varieties grown at the station. The 7 varieties averaged 64.42 per cent of water and 26.31 per cent of starch.

"In connection with these analyses it is to be remarked that the season during which these tubers were grown was remarkably dry, and this in a measure accounts for the low percentage of water and the comparatively high percentage of starch."

Calculated to a water content of 70 per cent, the average starch content was about 22 per cent.

Complete fodder analyses are also given of the 7 varieties grown at the station, including determinations of the cane sugar and glucose.

The value of the sweet potato as a starch producer is discussed and calculations are given showing that with a yield of 12,000 lbs. of sweet potatoes per acre the yield of starch would be about 2,640 lbs., about twice as much as the calculated yield from an acre of corn.

Analyses with reference to fertilizing ingredients are given of a number of samples of sweet potatoes, and on the basis of these analyses manuring of sweet potatoes is discussed. It is calculated that a crop of 200 bu. of sweet potatoes per acre would remove 27.36 lbs. of nitrogen, 10.2 lbs. of phosphoric acid, and 65.52 lbs. of potash, provided the vines were left on the land.

It is mentioned that the storage of sweet potatoes has received attention at the station and "it was found that among a great many materials tried cotton-seed hulls and dry sand gave the best results."

In an introductory note M. B. Hardin states that the mechanical separation of the starch in 1 sample showed 20.61 per cent as compared with the analytical result of 22.82, and 19.96 per cent in another sample as compared with the analytical result of 21.74 per cent of starch. The starch separated mechanically was found to contain 96 per cent of starch.

Desiccation and other industrial applications of potatoes, A. OEHRE (*Aarsber. Offent. Foranst. Landbr. Fremme, 1896, pp. 391–396*).

Historical facts about beet-sugar production and its taxation in Germany (*Deut. Landw. Presse, 24 (1897), No. 68, p. 614*).

Concerning Saccharomyces zopfii in sugar manufacture, etc., A. ARTARI (*Abhandl. Naturf. Gesell. Halle, 1897, pp. 22, figs. 8*).

The principles and practice of brewing, W. J. SYKES (*London: Charles Griffin & Co., Ltd., 1897; rev. in Analyst, 22 (1897), Dec., p. 335*).

Composition of different varieties of grapes and of different kinds of Sicilian wines in the year 1893, V. OLIVERI (*Atti. Staz. Chim. Agr. Sper. Palermo, Rap. 1893–'95, pp. 29, 30*).

On the use of pure cultures of yeast in wine making, J. BEHRENS (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), Nos. 13–14, pp. 354–369; 15–16, pp. 415–423; 17–18, pp. 486–491*).—An historical review of the subject.

On the making of wine from small berries, J. SEBELIEN (*Norsk Landmansblad, 16 (1897), No. 31, pp. 348–350*).

Raisin wine, P. CAZENEUVE (*Ann. Soc. Agr. Sci. et Ind. Lyon, 7. ser., 4 (1896), pp. 333–355*).

Grape wine and its substitutes, J. GRAFTIAN (*Bul. Agr. [Brussels], 13 (1897), No. 3, pp. 186–234*).—The article discusses processes of manufacture, etc., and gives much general information.

Influence of coloring matters on the fermentation of highly colored red wines, P. CARLES and G. NIVIÈRES (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 12, pp. 452, 453*).

On the formation of ammonia in wine, A. MÜNTZ and E. ROUSSEAUX (*Bul. [Min. Agr. France], 16 (1897), p. 11*).

Concerning the regulation of temperature during wine fermentation, E. O. MEINECKE (*Weinbau u. Weinhandel., 1897, No. 15–16, pp. 129–139*).

Recent studies on vinification and on the refrigeration of musts, A. MÜNTZ and E. ROUSSEAUX (*Ann. Sci. Agron., 1897, I, No. 3, pp. 374–399, fig. 1*).

The progress of vinification in Aude, L. SEMICHON (*Ann. Sci. Agron., 1897, I, No. 3, pp. 321–373*).

On "casse des vins," a new explanation based on the rôle of iron, H. LAGATU (*Compt. Rend. Acad. Sci. Paris, 124 (1897), No. 25, pp. 1461, 1462*).

On the absorption of oxygen in "casse du vin," J. LABORDE (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 4, pp. 248–250*).

Apropos of hydromel, R. PINCOT, (*L'Apiculteur, 41 (1897), No. 2, pp. 60–62*).—As an aid to fermentation dry raisins and tartaric acid are used. The latter is thought to be necessary with dry raisins, but not with fresh, since these have some acid of their own. The tartaric acid is added to the malt of honey and water at the rate of 60 gm. per hectoliter. A temperature of 25 to 28° C. is sufficient.

A study of the natural ferment of hydromel, E. KAYSER and E. BOULLANGER (*L'Apiculteur, 41 (1897), No. 9, pp. 350–357*).—The preparation of hydromel, a fermented beverage from surplus honey, is described and analyses of 9 samples are given and discussed. The production of hydromel is said to be quite difficult, the best conditions of fermentation not being well understood. These conditions are discussed in the light of data collected from a number of makers, and some suggestions are made as to the addition of foreign substances to influence the fermentation.

Vegetable fats and oils, L. E. ANDES (*Vegetabilische Fette und Oele. Vienna, Pest, and Leipsic: H. Hartleben, pp. 189, figs. 94; abs. in Ztschr. Nahr. Untersuch. u. Hyg., 10 (1896), p. 192*).

AGRICULTURAL ENGINEERING.

A study of waters for irrigation; the irrigation plant, G. L. HOLTER and J. FIELDS (*Oklahoma Sta. Bul. 29, pp. 14*).—Analyses with reference to mineral constituents are reported of 11 samples of river water, 12 samples of well water, and 3 samples of pond water. From these analyses the amounts of white and black alkali per 100,000 lbs. and per acre-inch are calculated and the adaptability of the different waters to irrigation purposes is discussed. Various suggestions are made regarding the construction of an irrigation plant, including dimensions of the reservoir and the capacity of pumps and windmills. Analyses with reference to sanitary condition of 12 samples of water are appended.

The forces which operate to destroy roads, with notes on road stones and problems therewith connected, C. L. WHITTLE (*U. S. Dept. Agr., Office of Road Inquiry Circ. 29, pp. 14, pls. 4*).

"Other things being equal, the endurance of a roadbed depends upon the qualities of the stone used, assuming the road to be properly constructed and adequately drained. A road is subject to attack and consequent loss of material in part by reason of the composition of the road metal of which it is composed. The means of attack brought to bear upon the surface of a road, in the order of their importance, are physical, dynamical, and chemical.

"The physical agencies are (1) the disrupting effects of frost, both on the integrity of the roadbed as a whole and on the individual rock fragments and minerals; (2) the transporting power of water in gullying the road, in washing particles of sand and clay to the side drains and ditches, and the sorting action of water whereby the winds are given better access to the finer and lighter parts of the products of road wear; (3) the transporting power of the winds; (4) the attrition and weakening effect of falling rain; (5) gravity.

"The dynamical agencies are (1) friction, which results from the grinding action of one fragment of rock against another under the action of carriage tires and the feet of animals; (2) the impact resulting from the same causes; (3) the disrupting effect of roots.

"The chemical agencies are (1) decomposition, shown, for example, by the disintegration of the feldspar-bearing rocks whereby the feldspars and other minerals are converted into clay, quartz, calcite, etc.; (2) solution, or the power possessed by surface waters impregnated with acids to dissolve most rocks and the products of decomposition of others and carry them away."

These different agencies are discussed in detail, as well as the essential qualities of road stones, the relation of decomposition to cementation, and the effect of moisture on a roadway. The structure of different classes of stone, including diorite, diabase, marble, and granite, are shown in plates made from microphotographs of sections of the stone. The planting of trees along highways is advocated and the chestnut is especially recommended for this purpose.

Irrigation in New Jersey, E. B. VOORHEES (*New Jersey Stas. Rpt. 1896, pp. 185–232, pls. 5*).—This article forms part of Bulletin 36 of this Office (E. S. R., 9, p. 97).

Trials of farm machinery, W. MÖLSE (*Biet* [*Helsingfors*], *18* (*1897*), *No. 5–6, pp. 141–144.*)—The trials were conducted under the auspices of the Nyland and Tavastehus County Agricultural Society (Finland) and included tests of mowing machines (7) and planters and cultivators (10).

Trial stations for agricultural machinery and apparatus (*Landtmannen, 8* (*1897*), *No. 33, pp. 457–460*).—Contains regulations for the trial stations for testing agricultural machinery and apparatus recently established at the agricultural and dairy institutes of Ultuna and Alnarp (Sweden).

Agricultural machinery in Germany and England, M. LANGBALLE (*Aarsber. Offent. Foranst. Landbr. Fremme, 1896, pp. 329–341*).

Silage presses, J. J. MORTENSEN-BARRIT (*Landtmannen, 8 (1897), No. 35, pp. 493, 494*).

Highway repairing, J. O. SANFORD and E. G. HARRISON (*U. S. Dept. Agr., Office of Road Inquiry Circ. 24, pp. 12*).—This includes accounts of the practical advantages of the daily care of country roads and notes on the improved roads at Canandaigua, New York, as well as opinions of leading citizens in the States of Wisconsin, Iowa, and Indiana relating to the working of a cash tax in those States.

Going in debt for good roads, THAYER (*U. S. Dept. Agr., Office of Road Inquiry Circ. 26, pp. 6*).—An address delivered before the Iowa Bankers' Association at Council Bluffs May 24, 1893.

Addresses on road improvement in Maine, New York, North Carolina, and Illinois, R. STONE (*U. S. Dept. Agr., Office of Road Inquiry Circ. 28, pp. 26*).—The text of addresses delivered before the State Board of Agriculture, Augusta, Maine, January 21, 1897, and before the General Assembly of North Carolina, Raleigh, North Carolina, February 5, 1897; remarks before the committees of Senate and Assembly at Albany, New York, February 25, 1897, and at the Good Roads Banquet of the League of American Wheelmen, Albany, New York, February 11, 1897; and a letter to the Illinois Farmers' Institute.

STATISTICS—MISCELLANEOUS.

Reports of director and treasurer of New Jersey Stations, 1896 (*New Jersey Stas. Rpt. 1896, pp. XXI, 1–15*).—Brief review of the work of the departments of chemistry, horticulture, dairy husbandry, biology, botany, and entomology during the year, and a financial report of the State Station for the year ending October 31, 1896, and of the College Station for the fiscal year ending June 30, 1896.

Annual Report of Oregon Station for 1897 (*Oregon Sta. Rpt. 1897, pp. 8–31*).—This includes reports by the director and heads of departments reviewing the work of the year and offering suggestions as to future work; a financial report for the fiscal year ending June 30, 1897, and a subject list of the bulletins (Nos. 1 to 47 inclusive) published since the organization of the station.

Annual Reports of the Department of Agriculture for 1897 (*U. S. Dept. Agr., Rpt. 1897, pp. 226*).—Executive reports.

Indiana agricultural statistics for 1895 (*Indiana State Bd. Agr., 1896, pp. 186–235*).

Iowa agricultural statistics for 1896 (*Iowa State Agr. Soc. Rpt. 1896, pp. 145–174, maps 22*).—A review of the crop season, with data showing the total acreage and the average yield per acre of various farm crops and the kinds, number, and distribution of farm animals in each county of the State.

Agricultural statistics, Ireland, 1897 (*Dublin: Alex. Thom & Co., 1897, pp. 39*).—General abstracts showing the acreage under crops and the number and description of live stock in each county and province, with notes on crop conditions during the last week in July, 1897.

Crop and live stock statistics, 1897 (*Kansas State Bd. Agr. Rpt. 1897, pp. 225–282*).—The tabulated data here given show the acreage, value, and yield per acre by counties of farm crops grown in the State; the number, value, and kinds of live stock, and the amount and value of their products; the yields and value of orchard and small fruits; the number of stands of bees, and the amount and value of honey and wax produced; and the acreage of newly planted forests and the kinds of trees planted.

Report on crops, live stock, etc., in Manitoba (*Manitoba Dept. Agr. and Immigration Bul. 54, pp. 18*).—Statistics on the acreage and yield of wheat, oats, barley, flax, rye, peas, potatoes, and roots; the number of live stock in the province and the number exported; production and price of dairy products, with general remarks by correspondents on crop and farm conditions.

Ohio crop and live stock statistics for 1896 (*Ohio State Bd. Agr. Rpt. 1897, pp. 19–74*).

Statistics of Ontario (*Ontario Bureau Ind. Bul. 63, pp. 24*).—Statistics of the several staple farm, orchard, and garden crops, showing the total area, product, and market value of the crops for 1896 and for the 4 years preceding, and the averages for 5, 10, and 15 year periods; the ratio of crops per 1,000 acres cleared land; the number, kinds, and value of live stock for the years 1892 to 1896; wages of farm laborers for 1895 and 1896 and the average for the years 1882–'96; output and value of cheese factories and creameries; value of farm property; number and amount of chattel mortgages; the world's wheat crop for the years 1894–'97; and the area and yield of field crops of Ontario for 1897.

Crops and live stock in Ontario (*Ontario Bureau Ind. Bul. 64, pp. 32*).—Final estimates of yield of crops in Ontario for the year 1897, with statistics of live stock for the years 1894 to 1897, and extracts from remarks by correspondents on miscellaneous farm topics. The yields of crops as given are based on actual threshing returns reported by nearly 4,000 correspondents.

Seventh annual report of the agricultural bureau of the department of agriculture, insurance statistics, and history, 1893–'94 (*Texas Agr. Bureau Rpt. 1893–'94, pp. 600*).—This includes agricultural and general statistics of each county in the State for the year 1893–'94.

Virginia agricultural statistics for 1896 (*Virginia State Bd. Agr. Rpt. 1896, pp. 38–55*).—Crop reports and statistics on acreage and yield of farm crops grown in Virginia in 1896.

Seventh annual report of farmers' institutes held in Ohio during the winter of 1896–'97 (*Ohio State Bd. Agr. Rpt. 1896, pp. 275–631*).—Includes a statement of the receipts and disbursements of the Ohio State Board of Agriculture on account of farmers' institutes for the season of 1896–'97; tabulated data showing the places where held, dates, attendance, etc., of the different institutes; a list of the lectures and their subjects; reprints of 58 miscellaneous papers; and the proceedings of the annual institute held at Columbus, with the full text of the papers read. The text of the Ohio State law governing farmers' institute societies and the rules of the State Board of Agriculture regulating their management are appended. In all 212 two-day institutes were held during the winter season. The attendance varied from 50 to 1,000, with an average of 353 and a total attendance of 76,815.

Proceedings of the ninth general meeting of the Association of Agricultural Experiment Stations in the German Empire at Wiesbaden, September 18 and 19, 1896 (*Landw. Vers. Stat., 49 (1897), No. 1–2, pp. 1–82*).—An account of this meeting has already been given (E. S. R., 8, p. 447).

Agricultural extension work: Sketch of its origin and progress (*New York Cornell Sta. Bul. 137, pp. 325–333*).—Previous accounts of the extension work of the College of Agriculture of Cornell University have been reported in Bulletins 110 and 122 of the station (E. S. R., 8, pp. 135, 790).

The present bulletin gives a review of the university extension work since its inception in western New York in 1893, and of the State legislation since affecting it; points out the purpose and general scope of the work and gives an account of its growth; and discusses the results secured by each of the different methods for the dissemination of agricultural knowledge thus far tried. At the present time there are enrolled in this university extension work 15,000 pupils and 10,000 teachers of the public schools and 1,600 young farmers.

Cost of hauling farm products to market or to shipping points in European countries (*U. S. Dept. Agr., Office of Road Inquiry Circ. 27, pp. 12*).—This circular gives the more important consular reports on this subject "received through the Department of State in response to the request of the Secretary of Agriculture for such information and in reply to circulars issued to the United States consuls by the Department of State." The countries represented are Belgium, England, France, Germany, Italy, and Switzerland.

NOTES.

MASSACHUSETTS COLLEGE AND STATION.—During the past year the greenhouse of the station has been materially altered. A new hot-water heater has been put in, and 3 ranges of houses have been built to be heated at different temperatures. These consist of a lean-to 25 by 25 ft. with a southern exposure and heated for cucumbers and tomatoes. The beds in this house are 2½ by 18 ft. and run East and West in tiers. There is also a lettuce house 12 by 40 ft. with earth beds, and a propagating house 12 by 18 ft. for general experimental purposes where a high temperature is not required. These houses have all been constructed with a view to getting the most uniform and normal conditions for physiological experiments. The appropriation for these changes was $1,500. In the horticultural department of the college and station an appropriation of $1,000 was made to remodel 2 greenhouses.

NEBRASKA UNIVERSITY AND STATION.—The following changes have been made in the governing board: E. Von Forell, of Kearney, has been appointed, *vice* C. W. Kaley, and George F. Kenower, of Wisner, *vice* E. A. Hadley.

NEW YORK STATE STATION.—H. A. Harding, of the University of Wisconsin, has been elected dairy bacteriologist of the station. He will spend the present year in study in this country and Europe and will assume his duties on January 1, 1899. George A. Smith, former director of farmers' institutes in New York and at present one of the dairy experts of the New York State Department of Agriculture, has been elected dairy expert at the station. It is expected that the new biological and dairy building will be ready for occupancy in the early summer of 1898.

RHODE ISLAND COLLEGE.—A special winter course of study and training in poultry culture has been successfully completed. The course lasted 4 weeks, beginning January 10, 1898. Instruction was given in zoology, the origin and breeds of fowls, principles of breeding and their application, care and management of fowls, feeding, diseases, construction of poultry buildings and appliances, drainage, records and accounts, etc. The plan was to devote the forenoons to lectures and class-room work; the afternoons to laboratory work and to practice in the carpenter shop, incubator house, and brooder house, and to the management, care, and feeding of fowls; the evenings to study, to meetings for discussion, etc. On Saturdays excursions were made to different poultry farms, markets, cold-storage establishments, etc. Special public lectures were planned. No entrance examinations were required, but examinations were held during and at the close of the course, on the basis of which certificates were awarded according to merit. The school was attended by 8 regular and as many more irregular students. Two of the regular attendants were women. Besides Rhode Island, pupils came from New York, New Jersey, and Massachusetts.

TEXAS COLLEGE.—L. S. Ross, president of the State Agricultural and Mechanical College of Texas, died January 3, 1898.

UTAH COLLEGE AND STATION.—U. P. Hedrick, formerly of the Oregon College and Station, has been elected horticulturist and botanist of the college and station, to succeed F. C. Sears, resigned. The latter has become director of the School of Horticulture at Wolfville, Nova Scotia.

EXPERIMENT STATION RECORD.

Vol. IX. No. 8.

A compilation of statistics relative to the land-grant colleges and the agricultural experiment stations in this country has just been completed by this Office. These statistics illustrate the magnitude of the enterprises for education in agriculture and the mechanic arts and for experimentation and research in agriculture which are fostered by the Federal and State Governments. The statistics for the colleges are much more complete than any which have hitherto been collected. Owing to the complex organization of many of the institutions, it has been found impracticable to give exactly comparable statistics in all cases, and in some instances it was impossible to obtain complete data.

There are at present 64 institutions receiving the benefits of the acts of Congress of July 2, 1862, and August 30, 1890. Sixty-one of these institutions maintain courses of instruction in agriculture. The aggregate value of the permanent funds and equipment of the land-grant colleges and universities in 1897 is estimated to be $51,274,546.60, classified as follows: Land-grant fund of 1862, $10,243,132.82; other land-grant funds, $1,319,133.41; other permanent funds, $8,567,619.27; land grant of 1862 still unsold, $2,399,383.70; farms and grounds owned by the institutions, $5,564,488.91; buildings, $13,994,205.64; apparatus, $1,533,282.38; machinery, $1,048,503.31; libraries, $1,425,004.88, and miscellaneous equipment, $1,935,290.51. The total number of acres of land granted to the States under the act of 1862 was 8,978,960, of which 1,066,519 acres are still unsold.

The income of these institutions in 1897, exclusive of the funds received from the United States for agricultural experiment stations, was as follows: Interest on land grant of 1862, $609,992.64; interest on other funds, $574,120.08; United States appropriation under act of 1890, $1,009,097.07; State appropriation (annual or regular), $1,477,-170.94; State appropriation (occasional), $318,901.07; tuition fees, $480,375.45; incidental fees, $50,555.98; miscellaneous, $708,971.47; total, $5,178,580.82. The value of the additions made in 1897 to the permanent endowment and equipment of these institutions is estimated at $1,370,518.71.

In 1897 the faculties of the colleges of agriculture and mechanic arts numbered 1,520 persons, of whom 240 were for preparatory classes and 1,372 for collegiate and special classes. In other departments of the institutions the faculties aggregated 791, making a grand total of 2,311 persons in the faculties of the land-grant institutions.

The students in 1897 numbered 28,885. Of these, 3,930 were in agriculture, 2,441 in mechanical engineering, 1,375 in civil engineering, 1,166 in electrical engineering, 575 in mining engineering, 393 in architecture, 1,051 in household economy, 354 in veterinary science, and 8,295 in military tactics. The graduates of these institutions in 1897 numbered 1,687, and since the organization of these institutions 25,737. The average age of graduates in 1897 was 21.9 years.

All of the States and Territories now have agricultural experiment stations receiving the benefits of the Hatch Act. Alaska alone has no experiment station, but a preliminary investigation regarding the feasibility of conducting agricultural experiments in Alaska was made by this Department the past year, and funds have been appropriated by Congress for inaugurating experiments there the coming season. In four of the States separate stations are maintained wholly or in part by State funds, and in Louisiana a station for sugar experiments is maintained partly by funds contributed by sugar planters. Excluding the branch stations, there are 54 stations, 52 of which receive the appropriation provided by the Hatch Act.

The total income of the stations during 1897 was $1,129,832.99, of which $719,993.47 was received from the National Government, the remaining $409,839.52 coming from the following sources: State governments, $287,176.35; individuals and communities, $5,553.88; fees for analyses of fertilizers, $37,265.26; sales of farm products, $64,437.83; and miscellaneous, $16,906.20. In addition to this, the Office of Experiment Stations had an appropriation of $35,000 for the past fiscal year, including $5,000 for the Alaskan investigation. The value of additions to equipment of the stations in 1897 is estimated as follows: Buildings, $74,830.99; libraries, $12,993.25; apparatus, $21,149.73; farm implements, $13,178.25; live stock, $14,733.07; miscellaneous, $7,714.08; total, $143,599.38.

The stations employ 628 persons in the work of administration and research. These are classified as follows: Directors, 67; chemists, 134; agriculturists, 66; horticulturists, 71; farm foremen, 38; dairymen, 19; botanists, 47; entomologists, 48; veterinarians, 30; meteorologists, 18; biologists, 8; physicists, 9; geologists, 6; mycologists and bacteriologists, 21; irrigation engineers, 6; in charge of substations, 11; secretaries and treasurers, 70; librarians, 9; and clerks, 38. There are also 30 persons classified under the head of "miscellaneous," including superintendents of gardens, grounds, and buildings, apiarists, herdsmen, etc. Two hundred and eighty-five station officers do more or less teaching in the colleges with which the stations are connected.

In 1897 the stations published 54 annual reports and 324 bulletins. Aside from these, a number of the stations issued press bulletins, which were widely reproduced in the agricultural and county papers. The station mailing lists now aggregate over a half million names.

AGRICULTURAL EDUCATION AND RESEARCH IN THE SCANDINAVIAN COUNTRIES AND FINLAND.[1]

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HIGHER AGRICULTURAL INSTRUCTION.

The institutions offering higher instruction in agriculture in the Scandinavian countries and Finland are 5 in number: Aas Higher Agricultural School, Aas, Norway (established 1859); Ultuna Agricultural Institute, Ultuna, Sweden (established 1849); Alnarp Agricultural and Dairy Institute, Aakarp, Sweden (established 1862); Royal Veterinary and Agricultural College, Copenhagen, Denmark (established 1773); and Mustiala Agricultural and Dairy Institute, Mustiala, Finland (established 1840).

All of these institutions are comparatively old, with traditions of their own, and plans of instruction suited to the particular conditions under which each institution is working. It is but natural, however, that the educational system followed at the different colleges should have been repeatedly modified and further developed in the course of time during their existence.

Higher Agricultural School at Aas.—At the present time the institutions of Norway and Finland, Aas and Mustiala, respectively, are under reorganization. In the former country the commission which has had the subject under consideration has prepared an elaborate report and recommended the organization of an agricultural college at Aas, the purpose of which shall be "to impart instruction based on a scientific foundation for the education of farmers, foresters, gardeners, allotment officers (surveyors), and dairymen, and to promote scientific research in the branches embraced by the college." The course is planned to last two years for all students except those in forestry, whose course lasts three years. The first year's studies are the same for all students, and during the second year classes are formed in agriculture, allotment, horticulture, dairying, and forestry. The buildings and increased instructional facilities rendered necessary by the reorganization will be provided for by a special appropriation of 682,000 crowns ($185,000), of which sum 250,000 crowns, or nearly $100,000, is for a new agricultural hall. The new college is planned to accommodate 120 to 150 students. The faculty will consist of a director, 11 pro-

[1] Continued from page 616.

fessors, and 6 instructors (*docenter*). The bill for the reorganization of the college was reported favorably last year by the committee on agriculture of the Norwegian Parliament, and is expected to pass and become a law during the present session of the Parliament.[1]

During its existence the Aas Higher Agricultural School has been frequented by nearly 1,000 students, the large majority of whom have been or are at the present time farmers in Norway. The course of instruction given lasts 1 year and is theoretical only, being arranged on the plan of the elementary agricultural 2-years' course given at the same school. The school is open to all persons sending in their applications accompanied by a doctor's certificate of freedom from contagious disease. The tuition fee is 200 crowns ($53.60) a year; students rooming and boarding at the school pay 400 crowns ($107.20) in addition. The attendance at the school is at present about 35 students a year. Like all the higher agricultural educational institutions in the Scandinavian countries, Aas is supported by Government appropriations solely, aside from the farm sales. The budget for 1893–'94 was 112,265.34 crowns ($30,342), about two-thirds of which was for instructional purposes and one-third for the farm. The latter portion was more than covered by the income from farm sales, amounting to very nearly 50,000 crowns ($13,500).

Mustiala Agricultural and Dairy Institute.—This institution (fig. 3), which was established as an elementary agricultural school in 1840, was enlarged in 1845 by the addition of a department for the training of agricultural teachers and farm superintendents. This department has gradually grown in importance since 1865, and has of late years been the main feature of the institute. The faculty of the institute is made up of a director (Dr. Gosta Grotenfelt); *lektorer* in chemistry and in botany; teachers in dairying, forestry, and veterinary science; "elementary teacher;" assistant chemist; and secretary and treasurer, 9 members in all. The attendance at the institute since its organization has been as follows:

Attendance at Mustiala Agricultural and Dairy Institute, 1840–'95.

	1840–'64.	1864–'81.	1881–'90.	1890–'95.	Total.
Agricultural department:					
Higher course	....	161	136	116	413
Elementary course	395	213	185	122	915
Dairy department:					
Higher course	....	....	31	31	62
Elementary course	....	114	15	16	145
Total	395	488	367	285	1,535

Students are admitted to the elementary course on similar conditions as to other Finnish elementary agricultural schools mentioned above. To the higher course, the agricultural institute proper, graduates of

[1] The law establishing the Agricultural College of Norway at Aas was passed May 22, 1897.

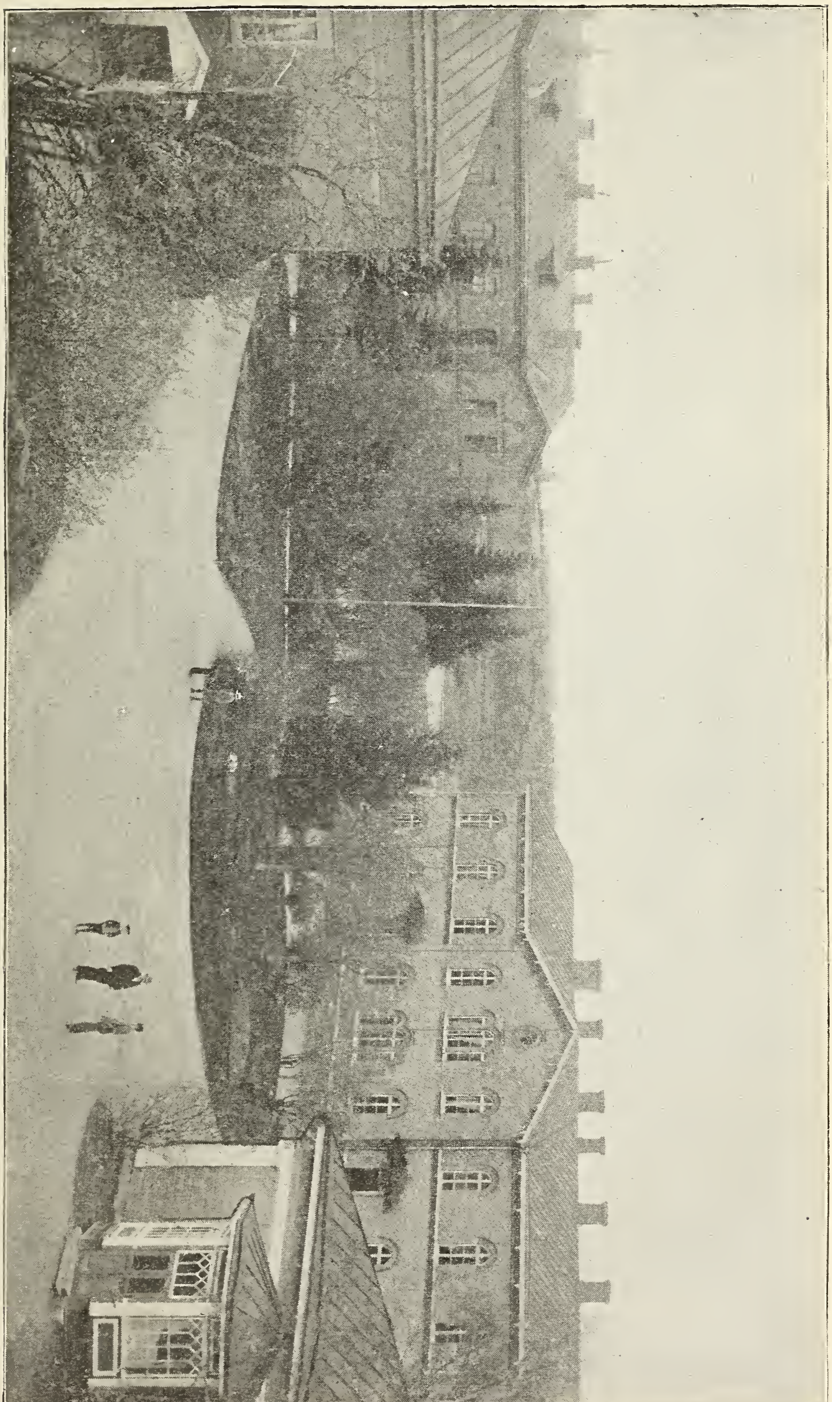

Fig. 3.—Agricultural and Dairy Institute at Mustiala, Finland.

the Finnish *lyceums* (corresponding to our high schools) and students holding a bachelor's degree from the State University at Helsingfors are admitted without examination, on presenting the required certificates from pastor and doctor as to age, moral character, general health, freedom from contagious disease, etc. Applicants having had at least a year's experience in practical farm work are given precedence in filling vacant places.

As in case of all Finnish educational institutions, the confusion of languages in Finland places the teachers at agricultural schools under peculiar difficulties. The Swedish-speaking population of Finland numbered 14.3 per cent in 1880, and the Finnish-speaking 85.2 per cent, the rest—less than 10,000—being made up of Russians, Germans, Laplanders, etc. Of the city population about 40 per cent are Swedish speaking. In the elementary schools located in the southwestern part of the country the instruction is given in Swedish, while in the other schools the Finnish language is used. In a few cases both Finnish and Swedish are used. Thus, at Mustiala, the professors, according to a Government decree, lecture in Swedish and Finnish in alternate years of the course, and they may therefore in one hour lecture to one class in Swedish and in the next hour to another class in Finnish.

For a number of years past there has been considerable discussion in Finland concerning the system of higher agricultural education. It has long been felt that the instruction at Mustiala under the conditions present—with the management of a 15,700 acre farm and of the higher and the elementary agricultural school alike in hands of the director of the institute—did not come up to what might reasonably be expected of a modern institution for the scientific training of young men in agriculture. The matter has been discussed by committees appointed by the Government and in the agricultural and daily press, and as an outcome a law has recently been passed providing 2 professorships at the Alexander University in Helsingfors, one in agricultural economics and agriculture, and the other in agricultural chemistry and agricultural physics, with an instructor (*adjunkt*) in botany and bacteriology, "in order to advance in this country scientific research and instruction in the subjects pertaining to agriculture." The advanced agricultural instruction will then be transferred to the State University, in connection with which an agricultural college will gradually be built up, and Mustiala will be reorganized as an intermediate agricultural school, with courses of instruction similar to those now offered at Kronoborg and Harjus.

Higher agricultural instruction in Sweden.—Turning our attention now to higher agricultural instruction in Sweden, we find here 2 well organized and equipped agricultural colleges, one each at Ultuna and Alnarp.

(1) Ultuna Agricultural College is the oldest Swedish agricultural college. It is located near Upsala, the university city, about 40 miles north of Stockholm. It has a faculty of 11 members, 4 so-called *lektorer*,

4 *adjunkter*, and 3 special teachers. There are about 50 students at the college. The course of instruction is arranged for 2 years, beginning November 1 and ending October 24, with a 3 weeks' vacation at Christmas and 7 weeks in summer time. The students generally hold a bachelor's degree, are graduates of Swedish technical institutions, or have similar qualifications. The instruction consists of lectures, laboratory work, "rounds," and excursions. During the junior year 635 to 675 lectures and 123 hours of laboratory work are given, and during the senior year 494 to 534 lectures, with 111 hours of laboratory work.

"Rounds" are made twice a week in the stock stables during the winter months by each class, under the direction, alternately, of the professors of animal husbandry and of veterinary science. Rounds in the creamery are made as suggested by the lectures in dairying, under the direction of the professor of dairying; and rounds in the barns and the fields are made occasionally during the winter, and regularly once a week with each class during the summer, under the direction of the professor of agriculture and economics. In all 6 or 8 geological excursions are made during the summer and 2 botanical excursions a week are made in the vicinity of the institute. Each summer an excursion, the plan of which is carefully laid a long time in advance, is made to estates at some, often considerable, distance from the institute. The expenses of these excursions are borne by the institute.

Two fellows (*stipendiater*) are appointed each year from the graduates having the best standing. They have a scholarship of 300 crowns ($81) a year, with free board and room, and may be reappointed for a second year. They do not ordinarily take part in the instructional work in the institute, but are free to devote themselves to special study. Regular students pay a tuition fee of 175 crowns ($47.30) and for board and room 500 crowns ($135) a year; special students (*hospitanter*) pay 75 crowns (about $20) a month. Four students, 2 in each class, are given scholarships.

The budget of the institute amounts to a little over $20,000, two-thirds of which is covered by Government appropriations. The farm connected with the institute contains 1,549 acres, and is well provided with instructional facilities, laboratories, library, museum, and farm live stock. About 200 milch cows (largely Ayrshire blood), 30 working horses, and 66 swine are kept.

(2) Alnarp Agricultural and Dairy Institute (fig. 4) is located in the southern part of Sweden, in the fertile province of Skaane, only about 20 miles from Copenhagen.

As at Ultuna, the course of instruction lasts 2 years. Lectures and recitations are given as follows: *Junior year*—Inorganic and organic chemistry (60 and 40 hours, respectively), with laboratory practice (about 250 hours); physics and meteorology (40 hours); geology (35 hours); anatomy and physiology (30 hours), with dissections; zoology (6 hours), general botany (30 hours), mechanics and engineering (30 hours), surveying

(15 hours), bookkeeping (50 hours), forestry (33 hours), general horticulture (25 hours), farriery (30 hours), and cameralistics (15 hours). *Senior year*—Agricultural chemistry (56 hours), applied botany (45 hours), agriculture (147 hours), history and economics of agriculture (38 hours), animal husbandry (25 hours); cattle, sheep, swine, and poultry raising (40, 8, 10, and 4 hours, respectively); dairying (56 hours), horse raising and exterior of the horse (25 hours each), veterinary science (28 hours), fish culture (7 hours), engineering and architecture (54 hours).

The faculty consists of 13 members. The number of students during 1894 was 98, the attendance in the different courses being as follows:

	Students.
Agricultural Institute:	
Higher department (4 scholarships)	27
Elementary department (24 scholarships)	44
Dairy Institute:	
Higher department (15 special students)	21
Elementary department	6
Total	98

FIG. 4.—Main building, Alnarp Agricultural and Dairy Institute at Aakarp, Sweden.

Regular students pay 675 crowns ($182.43) a year for tuition, room, and board. The incidental expenses, washing, light, and books, are about 160 crowns ($43.24) per year. Special students pay at the rate of 75 crowns ($20) a month, which includes charges for tuition, room, and board.

The Alnarp estate contains 1,390 acres of land, of which 735 acres are under cultivation, 103 acres are laid out in parks, yards, and roads, 25 acres are in orchards, and 267 acres are rented to tenant farmers. In

1896 160 acres (65 hectares) were planted to sugar beets. The gross receipts from the beet crops amount to about $13,000 annually. The beets are sold to the beet-sugar factory adjoining the estate. The Government appropriation for the institute is 29,400 crowns ($8,000) a year, and the budget about 60,000 crowns ($17,000).

Institutions for higher agricultural education in Denmark.—Among these is the Royal Veterinary and Agricultural College of Copenhagen, the oldest and largest of its kind in the Scandinavian countries or Finland. The college was established by Dr. P. C. Abildgaard in 1773 as the Danish Veterinary School. It received State aid from the beginning and became in 1776 a State institution, the Royal Danish Veterinary School. The school was reorganized and enlarged in 1858, and its name changed to that given above.

A number of changes and improvements have been made in the organization and plan of instruction of the college, the latest regulations being issued in 1892. The college, as now organized, has 5 separate departments, viz, veterinary, agriculture, land inspection (surveying, corresponding to the proposed course in land allotment in Norway), horticulture, and forestry. In addition there are post-graduate courses for veterinarians and agricultural students, and also a school for farriers.

To be admitted as a regular student, the applicant must either have a bachelor's degree or have passed the special entrance examinations prescribed, including 3 foreign languages. Students in the veterinary department are also required to pass an examination in Latin. There is furthermore an opportunity to be admitted as a regular student by special permission of the Department of the Interior. Special students are admitted without entrance examinations and may receive diplomas on the completion of the full course of study in any department. They are, however, restricted from receiving any of the scholarships of the college. Students must be at least 16 years old on entering the college, but the average age is considerably higher, being over 20 years.

The courses of study offered in the different departments are comprehensive and thorough, being designed to give to the student a liberal technical training and a good knowledge of the scientific principles underlying agriculture and kindred professions. The full course in veterinary science lasts 4½ years, of which time the last half year is devoted largely to practical work, hospital service, meat control, etc. The course is divided into 3 divisions, the first division taking 1 year, the second division 2 years, the third division, part 1, 1 year, and part 2, one-half year. At the completion of the work of each division, or each part thereof, examinations are held in all studies taken.

The course in agriculture lasts 1⅔ years, and is divided into two divisions. In division 1 the following lectures and recitations are given: Chemical physics, mechanics and optics, meteorology, inorganic and organic chemistry, analytical chemistry, geology and geognosy, soils, botany, biology, agricultural zoology, anatomy of farm animals, agricultural machinery; and laboratory or field work in chemistry, botany, horticulture, surveying, and drafting. In division 2 the lectures and recitations given are: Agricultural machinery (continued), plant culture, animal husbandry, dairying, farm bookkeeping, economics of agriculture, and plant pathology; and laboratory or field work in stock judging, agricultural chemistry, composition on agricultural topics.

The course in the department of land inspection is arranged in 3 divisions, of about $1\frac{1}{2}$, $1\frac{1}{4}$, and 1 year, respectively, or $3\frac{3}{4}$ years in all. The studies pursued are largely the general sciences, engineering, surveying, social economy, and general agriculture.

The course in horticulture requires $2\frac{1}{6}$ years, and that in forestry $3\frac{1}{2}$ years. The studies taught in these courses are the same as in the agricultural course, with the addition of technical subjects bearing on horticulture or forestry, respectively.

The total enrollment at the college in 1894–'95 was 365 students, of which number 301 were from Denmark, 52 from Norway, and the rest from other foreign countries. The different departments had the following attendance: Veterinary 217, agriculture 62, land inspection 22, horticulture 18, forestry 46, and the school in farriery 33 students.

The faculty numbers 28 members, exclusive of assistants in the different laboratories. There are 6 professors, 16 *lektorer* (associate professors), and 6 *docenter* (instructors). The budget of the college is very nearly 200,000 crowns ($54,000). In the statement of expenditures published the budget of the agricultural experiment station (about $20,000) is included, and the total expenses are given as follows: For salaries to director, instructional force, inspector, and bookkeeper, $28,460; for running expenses, $45,800.

The Danish Parliament in 1892 provided ample means for the reconstruction of old buildings and for the erection of new ones. These were finished in 1895, at a total outlay of about one million crowns ($268,000).

The Royal Danish Veterinary and Agricultural College in its present condition offers exceptionally good facilities to students, and is an institution of which any State or Nation might well be proud. Its veterinary department remains its strongest part, but the equipment in other lines, both as regards instructional force and working material, laboratories, museums, library, botanical garden, etc., is also complete and fully up to the standard of an institution commensurate with the importance and needs of agriculture and allied industries in Denmark.

DAIRY, HORTICULTURAL, AND OTHER SPECIAL SCHOOLS.

In addition to the strictly agricultural educational institutions enumerated in the preceding, some of which offer special courses in branches closely related to agriculture, a number of special schools of this kind are found.

Considering first the dairy schools, there are two higher dairy institutes in these countries, those of Alnarp, Sweden, and Mustiala, Finland. The courses given at both places are practical as well as theoretical, and last one year. At Ribe, Denmark, a dairy school giving 5-month and 3-month courses in dairying is in operation, and at least two of the elementary agricultural schools, Dalum and Ladelund, give quite complete elementary dairy courses. It is, however, somewhat strange to note that Denmark, whose dairy industry is of such vast importance and has made such remarkable progress during the past 20 years, has no dairy institute or school offering comprehensive advanced instruction in the science and practice of dairying. The course of lectures in dairying given at the Royal Veterinary and Agricultural College by Prof. T. R. Segelcke, the father of modern dairying in Scandinavia, includes 100 to 120 lectures, besides quizzes, the course being given to the agricultural students proper in their senior year. These lectures have been attended by nearly all teachers of dairying in the Scandinavian countries and Finland since the beginning of the seventies, at least by all present leaders in the dairy movement in these countries. Of almost as much importance, and perhaps more so, as far as Denmark is concerned, have been the 2-month to 3-month courses in practical dairying given under Professor Segelcke's direction at a large number of first-class creameries in different parts of Denmark. These courses have been attended by 1,048 students since their inception in 1864.

The elementary dairy schools in the other Scandinavian countries are as follows: In Norway, 10—3 for men (Brandbo, Hegre, and Stokke), 7 for women (Sande, Stange, Gaupen, Östensö, Vefsen, Örlandet, and Örsten); length of courses 1½ years. In Sweden, 19—3 dairy schools (Robertsfors, Huså, and Börjkfors), and 16 "dairy stations" (Berga, Bjerka-Säby, Aakerstad, Rjödenäs, Hvilan, Rånnum, Kilagården, Ökull, Frugården, Knistad, Torestorp, Rottneros, Trystorp, Stjernsund, Hedensberg, and Näs); length of courses 2 years. In Finland, 17—14 two-year schools (Myrans, Wiurila, Aittamäki, Haga, Pekkala, Järvikylä, Hovila, Simananniemi, Koivikko, Peltosalmi, Mattila, Orisberg, Klaresund, and Ruona), 3 one-year schools (Koivikko, Oulais, and Mustiala), also 2 herdsmen's schools (Saksala and Löfsta).

The special horticultural and other schools are as follows: In Norway, 2 (Aas and Sandnäs); in Sweden, 1 (Alnarp); in Finland, 5 (Helsingfors, Koristo, Kuppis, Kuopio, Haapavesi); in Denmark, 2 (Vilvorde and Beder). The forestry schools are: Norway, 2 (Kongsberg and Stenkjär); Finland, 1 (Evois). And the farriery schools are 1 each in Sweden (Alnarp) and Denmark (Copenhagen) and 3 in Finland (Helsingfors, Aabo, and Wiborg).

INSTITUTIONS FOR AGRICULTURAL INVESTIGATION.

The work done in the line of agricultural research in the Scandinavian countries and Finland offers perhaps less of importance to outsiders than the system of agricultural education found there. The main interest centers around the work of the experiment stations at Copenhagen and Albano (near Stockholm). A few other stations are largely engaged in original investigations, notably the Swedish Moor Culture Association at Flahult and the Seed Improvement Society at Svalöf, Sweden, and important results have been obtained through their efforts. But as regards at least the former of these, similar work on a larger scale and under more varied conditions is being conducted elsewhere. While experiments on agricultural problems are being conducted in all four countries, the attention of the workers, except at the stations at Copenhagen and Albano, is occupied mainly with either instructional or chemical control work instead of investigation. Hence, the continuity and concentration of efforts so essential in investigation is often lacking. This does not prevent these institutions from occasionally publishing, through the perseverence and enthusiasm of their officers, valuable contributions to our fund of scientific agricultural knowledge, as will be apparent from the reports of the institutions reviewed in the Experiment Station Record during the past 5 years. As this work speaks for itself, it will not be necessary to dwell in this article on the results obtained, and attention will be confined to a brief statement of the history of the various stations, their organization, plan of work, officers, means of support, etc.

EXPERIMENT STATIONS IN NORWAY.

The control or experiment stations in Norway are as follows:

The State Chemical Control Station at Christiania was organized as a separate institution in 1891 and began work February 1, 1892. Previous to that time, since 1863, analyses of agricultural products for private parties had been made by the teacher of agricultural chemistry at Aas or his assistant, for which purpose the Society for Norway's Weal or the Government made a small appropriation, except during a few years (1869–'75) when no money was appropriated from either source. The budget of the station is 12,500 crowns ($3,378), of which 5,600 crowns ($1,513) goes to pay the salaries of director, assistant, and janitor. The director reports directly to the Secretary of Agriculture, there being no connection between the station and the agricultural college at Aas. The work of the station is published in the annual report of the secretary and in occasional contributions to the agricultural press. No provisions are made for bringing the results of work done before the public through periodical bulletins or special publications.

During 1895, 897 samples of feeding stuffs, dairy products, fertilizers, water, etc., were sent to the station for analysis. In addition to the control work a goodly number of original investigations have been made and published, reviews of which have been given in the Record.[1]

Plant Physiological Station at Aas, established in 1895. The work of the station is largely cooperative and includes the testing of varieties

[1] E. S. R., 5, pp. 537, 1021; 6, pp. 11, 23, 25, 36, 82, 84, 110, 156, 163, 250, 568; 7, pp. 519, 526, 712; 8, pp. 151, 152.

and of systems of rotations at Aas, and at a number of farms in different parts of Norway, thus giving varying conditions as to soil, climate, treatment, etc. The experiments in progress during 1896 were conducted in 12 different places and included the following series of trials: Potatoes (English, German, and Norwegian varieties) 12 series, barley 12 series, oats 16, clover seed 13, lupines 6, infective trials on lupines 21, sugar beets 6, miscellaneous crops 6. The station furnishes the seed and sends an assistant to sow it and to harvest the crops, while the different farmers prepare the soil, take care of the crop during the growing period, and have the crops, minus the small quantities wanted for samples. The assistants have free room and board at the farms while doing the work of the station. The size of the plats are as follows: Oats 28.5 by 42 meters; barley and winter grains 28.5 by 28.5; hay crops—grasses and clovers 20.5 by 49; lupines 32 by 65; potatoes, turnips, etc., 12.5 by 47; and sugar beets 9 by 70 meters.

The station receives 10,000 crowns ($2,680) annually from the Society for Norway's Weal, but has no State aid. The results of the work done are published in the annual report of the Secretary of Agriculture and in contributions to the agricultural press (E. S. R., 6, p. 543; 8, p. 118). The station staff consists of a director, first assistant, and a number of traveling assistants.

The chemical department of Aas Agricultural College, practically without any funds set apart for investigational purposes, has, nevertheless, been able to publish considerable work in this line.[1]

Milk control stations are established at Christiania, Trondhjem, and Bergen. Creameries and individual farmers have an opportunity to send in samples of milk for the determination of the fat content, the charges being 10 öre (2.7 cents) per single sample or 5 öre in large numbers. The first two stations were established in 1894, and the third in 1896. During 1895 the stations in Christiania and Trondhjem examined 16,600 and 12,943 samples of milk, respectively, about 95 per cent of the samples coming from creameries. The average percentage of fat in the creamery samples in 1895 was 3.44 for Christiania and 3.41 for Trondhjem. De Laval's butyrometer is used for making the tests. The stations have no officers except a superintendent. The annual State appropriation is 2,500 crowns ($676) for each station.

EXPERIMENT STATIONS IN SWEDEN.

Sweden has 7 chemical stations, largely supported by the Government. Four of these were established in 1876, one in 1881, and two in 1885. They received a State appropriation of 3,000 crowns ($811) each per year until 1888, when the appropriation for the 4 older stations was increased to 4,000 crowns ($1,081), and the following year this was extended to all the stations. In addition the various county agricultural societies give annual grants ranging in 1895 from 950 to 4,650

[1] E. S. R., 4, pp. 517, 783; 5, pp. 958, 1017; 6, pp. 199, 250, 475, 927, 1023; 7, p. 979; 8, p. 122.

crowns ($257 to $1,257) for the different stations. The income from analysis fees ranged from 1,216.50 to 3,188.60 crowns ($329 to $862). In case of 2 stations the director receives all analysis fees and in return pays for chemicals and other materials used. The personnel of the stations generally consists of a director and one or two assistants. The stations publish an annual report giving in more or less detail the results of the work of the year. A summary for each station is also published annually in the report of the Agricultural Department.

The summary of work done by the various stations during 1895 is given in the following table:

Number of samples analyzed or examined by chemical stations in Sweden during 1895.

	Jönköping.	Kalmar.	Halmstad.	Skara.	Örebro.	Vesterås.	Hernösand.	Total.
Soils	213	51	2	14	21	21	28	350
Soil "amendments"	117	6	20	19	5	16	3	186
Fertilizers	127	233	373	103	91	51	26	1,004
Feeding stuffs	72	72	46	27	76	42	67	402
Water	64	52	31	144	35	17	109	452
Dairy products	12	1,582	6,632	2,209	2,508	16,645	56	29,644
Human food articles	117	23	59	7	25	13	34	278
Poisoning cases	460	78	2,095	168	812	278	82	3,973
Technical and sundry products	50	92	27	31	134	28	81	443
Total	1,232	2,189	9,285	2,722	3,707	17,111	486	36,732

The sum total of samples examined during the year, as will be seen, is 36,732. It is natural, with this amount of control work to be done, that but little can be accomplished in the line of original investigations of agricultural problems. During the 3 preceding years (1892–'94) 22,461, 26,355, and 35,740 samples, respectively, were examined, showing that the public make use of the stations in an increasing ratio from year to year.

In addition to the preceding stations a number of county agricultural societies have for a number of years past made arrangements with the chemical departments of certain agricultural schools to have chemical analyses made for farmers in their respective counties at a special low rate, and have set apart a certain sum of money annually for this purpose. The number of samples analyzed by such chemical stations during 1895 is shown below:

Number of samples examined by county chemical stations in Sweden during 1895.

	Upsala.	Kristianstad.	Alnarp.	Molkom.	Gefle.	Umeå.	Grand total.
Soils, etc	7	29	21	25	....	41	....
Fertilizers	23	46	38	52	....	9	....
Feeding stuffs	15	35	77	69	....	....	....
Water	2	39	....	3	....	4	....
Dairy products	....	21,411	4,406	35	....	7	....
Poisoning cases	....	30	....	....	....	135	....
Technical and sundry products	4	68	21	41	....	12	....
Total	51	21,658	4,563	225	1,498	208	28,203

Research or control work conducted at Swedish chemical stations has been frequently noted in the Record.[1]

A chemical plant-biological station was established at Luleå in 1895, and began work November 1 of that year, with a director and assistant as its officers. No report has yet been issued from this station.

Variety tests and fertilizer experiments with different crops are made every year at a large number of agricultural schools, and under the auspices of county agricultural societies. So far as known, no regular appropriations are made for this work. The results of the trials are published in the annual report of the Agricultural Department under the summary reports of the various schools.

Fig. 5.—Chemical Department, Experiment Station at Albano, Sweden.

Experiment Station of the Royal Agricultural Academy at Albano.—This station (*Experimentalfältet*), founded in 1883, is confined to research work. It has 3 distinct departments—chemical (fig. 5), plant-physiological, and agricultural-horticultural. The officers are a director (chemist), assistant chemist, botanist, and agriculturist. A number of assistants have also at times been temporarily employed. The annual budget of the chemical department is about 12,000 crowns ($3,243). Special appropriations have been made for buildings, experimental glass house, and garden, etc. The physiological department in 1889–'91 received a special appropriation of 10,000 crowns ($2,680) for

[1] E. S. R., 4, p. 777; 5, pp. 520, 536, 1025; 6, pp. 109, 241, 373, 577; 7, pp. 247, 520, 669, 701, 717, 826, 845; 8, pp. 151, 153, 154, 161, 168, 173.

conducting investigations on the grain rusts, which Prof. Dr. Jakob Eriksson has made the subject of a special life study. The sum of 7,700 crowns ($2,080) was at the same time appropriated for the publication of the results obtained.

The work of the experiment station has been, besides the study of the grain rusts, investigations of Swedish forage plants and soils, fertilizer experiments (pot, plat, and field trials) with different crops, cooperative variety tests, dairy experiments, feeding experiments with milch cows, etc. The reports of the work done are published in the Transactions of the Royal Agricultural Academy (*Kongl. Landtbruks-Akademiens Handlingar och Tidskrift*), which appear bimonthly, and also in the periodical press.[1]

The Swedish Seed Corn Association (*Sveriges Utsädesförening*) has an experiment station at Svalöf, Sweden, established in 1886 for the purpose of improving the cereals and other agricultural plants by systematic breeding and selection, so-called pedigree culture. The station receives an annual appropriation from the State of 15,000 crowns ($4,054), also grants from the various county agricultural societies, amounting in 1895 to 16,900 crowns ($4,568). In addition the State gives 3,000 crowns ($811) to defray the expenses of distributing the pure-bred seed in trial lots to farmers. In 1895, 41,200 kg. of oats was distributed to 412 farmers. The association has 5 substations in different parts of Sweden, at which improved seed corn is grown on large plats for supplying the material to be distributed during the succeeding year.

The work of the station, under the able direction of Dr. N. Hjalmar Nilsson, has been most successful. A number of new varieties have been propagated, and standard varieties of oats, wheat, barley, peas, and vetches greatly improved. Of the apparatus designed, special mention may be made of the "Svalöf Seed Preparer" (seed coat crusher) for destroying the hard seed coat of leguminous seeds, thus increasing their germinative ability. The new apparatus has a capacity of 1 to 2 bags of clover seed per hour.

The results of the work of the station are published in a quarterly publication, *Svenska Utsädesförenings Tidskrift* (E. S. R., 5, p. 521).

The Swedish Moor Culture Association at Jönköping was established in 1886. Sweden has between 12 million and 18 million acres of marsh land still largely uncultivated. The work of the Moor Culture Association, through its investigations and demonstrations at Jönköping (pot and plat experiments) and at Flahult (field experiments), as well as through the publication of its magazine, *Svenska Mosskultur-föreningens Tidskrift*, has largely increased the knowledge of the capabilities of Swedish marshes. The experimental work is planned along similar lines as the experiment station for moor culture at Bremen, Germany.

[1] E. S. R., 4, pp. 768, 963, 965, 971; 5, pp. 808, 1017; 6, pp. 200, 389, 407, 432, 669, 890; 7, pp. 714, 746; 8, pp. 152, 203, 209, 248.

The experimental fields at Flahult, 8 miles south of Jönköping, have a total area of 200 acres, of which 50 acres are under cultivation, 75 acres are unimproved marsh land, 60 acres forest area, and 15 acres buildings, roads, etc.

The Association receives an annual State appropriation of 10,000 crowns ($2,680), and grants from other sources, county boards, agricultural societies, private parties, etc., aggregating about 25,000 crowns more ($6,760). Its officers are a director, engineer, and 3 station assistants (E. S. R., 8, p. 297).

EXPERIMENT STATIONS IN DENMARK.

In Denmark systematic studies of agricultural problems are pursued at the experiment stations at Copenhagen and at Tystofte, as well as by the Royal Danish Agricultural Society and a number of county agricultural societies.

Experiment Station at Copenhagen.—The history of this institution—the Laboratory of the Royal Veterinary and Agricultural College for Agricultural-Economic Experiments—has already been given by the writer in the Record (E. S. R., 6, p. 585), to which article reference is here made. The station publishes occasional bulletins (*Beretninger*), the 36th of which (Investigations of faults in the consistency of butter and of the constitution of the fat globules of milk, by Prof. V. Storch) has recently been noticed (E. S. R., 9, p. 176). The greater share of the work done by the station has been connected with the dairy industry. This station carries on the very important cooperative feeding experiments with milch cows (E. S. R., 6, pp. 585, 657; 8, p. 255) and pigs (E. S. R., 5, p. 428; 7, p. 242), series of which are conducted each winter; also the permanent butter exhibitions (E. S. R., 5, p. 721; 7, p. 626; 8, p. 172), originated by Professor Fjord; and investigations on tuberculosis and its eradication in dairy animals. The tuberculin experiments, conducted on a very extensive scale during the past 4 years, are still in progress, and no official report of the same has yet been published.

The budget of the station for 1894–'95 was as follows:

Salary to assistants in cooperative feeding experiments with milch cows and pigs, and traveling expenses	$9,559
Other expenses connected with these experiments	1,566
Chemical department (salaries of 5 assistants, and chemicals and apparatus)	2,244
Bacteriological department (laboratory experiments)	2,443
Animal physiological experiments	603
Experiment station, apparatus, labor	2,010
Printing	1,164
Traveling expenses of director	107
Office, executive expenses	1,945
Tuberculin experiments	2,093
Permanent butter exhibitions	6,432
Total	30,166

It will be noticed that the salaries and expenses as assistants superintending the cooperative feeding experiments alone amount to nearly $10,000. The budget for the butter exhibitions during 1894 was $32,000, of which amount about $28,000 was for butter; $25,600 was realized from the sale of the butter, making a loss of $6,500, which was nearly covered by the special annual appropriation of 24,000 crowns ($6,432). Beginning April, 1895, this appropriation was increased to 30,000 crowns ($8,108) per annum.

The chemical department (fig. 6) is in charge of Prof. Dr. V. Storch, and the veterinary-bacteriological department of Prof. Dr. B. L. F. Bang. The regular staff of the station consists of a director, chemist, 5 assistant chemists, veterinarian, assistant veterinarian, animal physiologist, superintendent and 4 assistants connected with cooperative experiments, and bookkeeper, a total of 16 officers. No chemical control

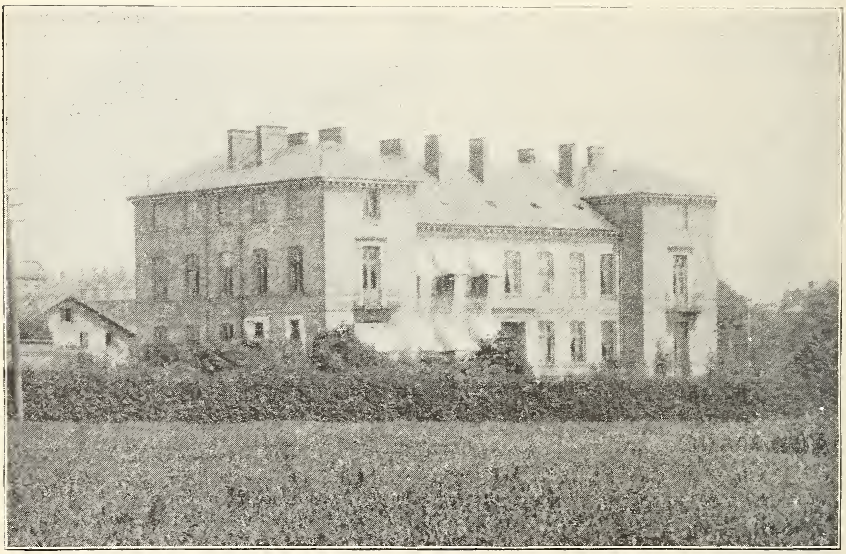

FIG. 6.—Chemical Department, Experiment Station at Copenhagen, Denmark.

work or regular lecture work is done by any of the staff, except the veterinarian, animal physiologist, and one of the assistant chemists, who are also teachers at the Royal Veterinary and Agricultural College.

Abstracts of work done at the station have been given from time to time in the Record.[1]

Experiment Station at Tystofte.—The State maintains an experiment station in plant culture located at Tystofte (near Skjelskör, Seeland), with branch stations at Askov, Vester Hassing, and Lyngby. A vast amount of work is done at these stations and at farms cooperating with them in the line of variety tests with cereals, legumes, and roots; experiments as to proper methods of seeding and plowing, hybridiza-

[1] E. S. R., 4, p. 601; 5, p. 721; 6, pp. 585, 657; 7, pp. 242, 253, 254; 8, p. 172.

tion; rotation and fertilizer experiments, etc. (E. S. R., 7, p. 203). The station at Tystofte has an area of about 54 acres, and the branch stations from 19 to 45 acres. The latter are located in different parts of Denmark and represent marked differences as to character of soil, etc.

Investigational work done under the auspices of the State or county agricultural societies or at agricultural schools has largely been limited to analytical work and variety and fertilizer trials, and can only be referred to here.[1]

EXPERIMENT STATIONS IN FINLAND.

For a number of years past (since 1881) the Mustiala Agricultural and Dairy Institute has conducted experiments in plant culture, acclimatization and fertilizer tests, feeding experiments with dairy cows, tests of dairy apparatus, tuberculosis investigations, etc., under the direction of the professors at the institute. Only a small sum of money (2,000 marks=$386) is, however, set apart annually for this work, and what is done is done incidentally, the primary work of the officers being that of instruction. The investigations conducted at the institute are published as reports (*Meddelanden*) of the Agricultural Department, of which 18 have been issued up to date.

An agricultural botanical experiment station was established in Herrenäs in 1889, the special object of which is to make culture experiments with wild grasses and legumes in order to learn their adaptability for permanent pastures. Trials with such plants are also made at a number of private farms, under the direction of the superintendent of the station. The station has an appropriation of 3,500 marks ($675) per year from the county agricultural society. Only one report has been published, viz, for the years 1889–'93.

Finland has 2 "chemical stations," one at Helsingfors and the other at Aabo. The former was established in 1880 and the latter in 1882. Only control work is done at these stations. The number of samples examined at the Helsingfors station in 1895 was 2,028, and at Aabo in 1894, 905. The budget of the chemical station at Helsingfors is about 15,000 marks ($2,715). The station staff consists of a director and 2 assistant chemists. Several of its published articles have been noted in the Record.[2]

SEED CONTROL STATIONS.

The seed control stations of the Scandinavian countries, of which there are a considerable number, have not been included in the preceding sketch. It is planned to treat these in a separate article later.

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[1] E. S. R., 5, p. 813; 6, pp. 455, 936; 7, pp. 206, 224, 491; 8, pp. 153, 161, 173.

[2] E. S. R., 6, pp. 394, 410, 453, 457, 477, 519, 524, 534, 575.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The principal amid of sugar cane, E. S. SHOREY (*Jour. Amer. Chem. Soc., 19 (1897), No. 11, pp. 881–889*).—As a result of investigation the author finds that the "principal amid compound present in sugar cane is not optically active, and is not asparagin [as stated by Maxwell[1]], but glycocoll or glycocin, an amid not heretofore known to occur in plants." The method of preparing the amid and the physical and chemical characteristics of the crystals are described, together with the ways in which it resembles and is distinguished from asparagin.

Fifteen preparations of glycocoll were made from sugar cane at different stages of growth, including the young shoots of the cane a few weeks old, the green tops of cane 1 year old, and mature cane growing at elevations of from 400 to 1,200 ft. No attempts were made to estimate the quantity, but the author noticed that larger amounts were obtained from young than from mature cane.

"It is fair to conclude that glycocoll is not only the principal amid of sugar cane, but is also a normal constituent of this plant at all periods of its growth. . . . Its occurrence has not been noted in a plant before, and it has been considered a body belonging wholly to animal chemistry. . . .

"The identification of glycocoll in sugar cane and the fact that it has been mistaken for asparagin suggests the probability of its occurrence in other plants, especially the Gramineæ, which forms the major part of the food of herbivorous animals; and it is quite likely that the source of the hippuric acid in the urine of such animals will be found in such occurrence."

The author considers the matter from the sugar manufacturer's point of view. He has obtained glycocoll in comparatively large quantities from several samples of refuse molasses. He believes that "a body such as glycocoll would exert little effect on the crystallization of sugar one way or the other, especially as it exists in cane in such small amounts, but it is likely that the proteid directly connected with glycocoll will be found to be highly molassigenic."

Toxalbumoses which coagulate blood, M. ELFSTRAND (*Ueber giftige Eiweisse welche Blutkörperchen verkleben. Upsala: Almqvist & Wiksells Boktryckeri-aktiebolag, 1897, pp. 192*).—This is an extended study of the toxalbumoses in croton seed. The poisonous albumen was

[1] Louisiana Stas. Bul. 38, 2. ser. (E. S. R., 7, p. 645).

extracted with water and with a physiological solution of salt from the powdered seed, first removing fat, etc., with alcohol and ether. The greater portion of the book is devoted to a report of experiments on the effect of the croton-seed extract on the blood and blood constituents. The author gives a brief account of previous investigations on croton seed and its poisonous properties, and also on abrin and ricin.

Report of the chemist, R. DE ROODE (*West Virginia Sta. Rpt. 1891, pp. 21–41*).—This report is devoted to a brief summary of the work of the year in the chemical department of the station and descriptions of methods for the determination of phosphoric acid in fertilizers, for the analysis of soils, and for the determination of fertilizing ingredients in plants, together with analyses of fertilizing materials, muck, water, soil from experimental plats, and grasses and weeds with reference to food and fertilizing constituents.[1] A method is given for the determination of phosphoric acid and nitrogen in the same weighed sample of fertilizer, which has already been noted.[2] The methods used in the analysis of soils and of the ash of plants are given in detail. The principal advantage claimed for the method of soil analysis is that it calls for larger quantities of soil than are usually prescribed, and thus gives larger precipitates with which to work. In other respects the methods are mainly modifications of well-known processes.

The determination of nitrogen in organic substances by the Kjeldahl-Wilfarth method, R. DE BÖHTLINGK (*Arch. Sci. Biol.* [*St. Petersburg*], *5* (*1897*), *Nos. 2–3, pp. 176–196; abs. in Chem. Ztg.*, *21* (*1897*), *No. 89, Repert., p. 254*).—The method is recommended for the determination of nitrogen in substances of animal origin. Of solutions use 100 cc., of solids 1 to 3 gm. Add to the substance in a 100 cc. digestion flask 10 to 20 cc. of a solution of 200 gm. of phosphoric anhydrid in 1 liter of pure concentrated sulphuric acid. Add about 0.1 cc. of mercury and heat the flask gently until frothing ceases, then more strongly until the solution is colorless. Allow the solution to cool, fill the flask half full with water, and close it with a rubber stopper while the contents are cooling. Place the solution in a distilling flask with a spoonful of talc and a few drops of alcoholic solution of phenolphthalein diluted with an equal amount of water. Add soda solution (333 gm. per liter of water) until slightly alkaline, and pour in quickly 12 cc. of a solution of potassium sulphid (1 part of the sulphid to 1.5 parts of water). Close the flask immediately with a rubber stopper carrying a condenser, the upright part of which is at least 30 cm. long and of such a diameter that the condensing steam does not obstruct it. Connect the other end of the condenser with a Peligot tube containing 20 to 50 cc. of dilute sulphuric acid, to which a little Congo solution (in water) and sufficient water to close the opening of the tube are added. Distil the ammonia and titrate as usual.

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[1] See also West Virginia Sta. Buls. 19 and 22 (E. S. R., 3, pp. 629, 892).

[2] U. S. Dept. Agr., Division of Chemistry Bul. 31 (E. S. R., 3, p. 633).

The determination of the total volatile fatty acids in butter, E. WRAMPELMEYER (*Landw. Vers. Stat., 49 (1897), No. 3, pp. 215–218*).—The author notes two defects in the Wollny method, *i. e.*, the failure to determine all of the volatile fatty acids and the difficulty of completely removing the alcohol used in saponifying. The latter difficulty has been overcome by the use of glycerin-sodium hydrate as proposed by Leffmann and Beam. The author has combined this method of saponification with distillation by means of superheated steam.

The method is as follows: Approximately 5 gm. of filtered fat is saponified in a flask of 700 to 800 cc. capacity with 20 cc. of glycerin-sodium hydrate[1] by heating over the direct flame, and after frothing has ceased 250 cc. of hot distilled water, previously boiled to expel carbonic acid, is added with a drop of indicator (litmus) and 50 cc. of sulphuric acid.[2] The flask is immediately connected with a safety bulb and condenser, and distilled by means of superheated steam generated from distilled and previously boiled water and superheated by passing through a heated copper tube 30 cm. long and 1.4 cm. in diameter. With this apparatus 1½ liters were distilled over in 1½ hours, the distillate being collected in 2 portions of 1 and ½ liters, respectively.

The results of a number of determinations in comparison with other methods are given. The author calls particular attention to the necessity of thoroughly boiling the water previous to use to expel all carbonic acid, and of preventing by mechanical means any of the alkali going over into the filtrate. The results by the new method were considerably higher than those by the Leffmann and Beam method, 5 or 6 cc. more of decinormal alkali per 5 gm. of melted fat being required. This, the author holds, increases the exactness of a determination of the adulteration 15 to 20 per cent, since the numbers for oleomargarin are not higher than those given by the Wollny method.

The detection of foreign fats in lard and butter, C. B. COCHRAN (*Jour. Amer. Chem. Soc., 19 (1897), No. 10, pp. 796–799*).—For detecting beef fat in lard 2 cc. of melted fat and 22 cc. of fusel oil are heated to obtain a perfect solution and then cooled to 16 to 17° C., this temperature being maintained for 2 or 3 hours. A crystalline deposit forms, from which the fusel oil is allowed to drain off, and the residue recrystallized from ether. "By this method I have been able to detect the presence of a smaller amount of beef fat than I could detect when the sample was directly crystallized from ether."

Data for 27 samples of lard and fat of various kinds are tabulated.

For butter or oleomargarin the method is as follows:

"Add 8 cc. of fusel oil to 2 cc. of the filtered fat; warm until a perfect solution is obtained, then cool to 16 or 17° C. A deposit will be formed which, in the few experiments I have made, has been greater in the case of oleomargarin than in

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[1] Dissolve 100 gm. NaOH in 100 cc. of water and mix 20 cc. of this with 180 cc. of concentrated glycerin.

[2] Mixture of 20 cc. of concentrated sulphuric acid (sp. gr. 1.84) in 1 liter of water.

butter. When this deposit is crystallized from ether very perfect crystals of large size are obtained. Up to the present time I have only examined 6 samples by this method, 3 of butter and 3 of oleomargarin, and as the crystals obtained in the two cases are in some respects similar, I do not feel able to make a positive statement in regard to the diagnostic value of this test in all cases. However, the difference in the appearance of the crystals, so far as I have yet observed, seems to be sufficiently great to serve as a means of distinguishing butter from oleomargarin."

The carbohydrates of rye, barley, and wheat at different periods, H. Jessen-Hansen (*Medd. Carlsberg Lab., 4 (1896), pp. 145–193; abs. in Centbl. Agr. Chem., 26 (1897), pp. 630–636; Jour. Chem. Soc. [London], 72 (1897), No. 421, II, p. 581*).

On the chemical behavior of diastase and the determination of its action when soluble starch is used; and on araban found in diastase preparations, I. A. Wróblewski (*Ztschr. Physiol. Chem., 24 (1897), No. 3, pp. 173–223, figs. 5*).

On the duration of the activity of the oxidizing ferments of mushrooms in solution in glycerin, E. Bourquelot (*Compt. Rend. Soc. Biol. Paris, 1897, p. 454; abs. in Bul. Soc. Chim. Paris, 3. ser., 17 (1897), No. 24, p. 1051*).—By macerating 250 gm. *Lactarius velutinus* for 1 hour in 850 gm. of glycerin and filtering, a solution was obtained which did not undergo decomposition or lose its oxidizing properties for a year.

Investigations on the constituents of protein: A new method of separating albumomoses and peptones, E. P. Pick (*Ztschr. Physiol. Chem., 24 (1897), No. 3, pp. 246–275*).

On the cleavage products of a protein compound prepared from seeds of Coniferæ, E. Schulze (*Ztschr. Physiol. Chem., 24 (1897), No. 3, pp. 276–284*).

Chemical and bacteriological investigation of the fermentation of fresh grass, O. Emmerling (*Ber. Deut. Chem. Gesell., 30 (1897), pp. 1869, 1870; abs. in Jour. Chem. Soc. [London], 72 (1897), No. 421, II, p. 579*).

On the analysis of silicates, A. Leclèrc (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 22, pp. 893, 894*).

A comparison of various methods for determining carbon dioxid and carbon monoxid, L. M. Dennis and C. G. Edgar (*Jour. Amer. Chem. Soc., 19 (1897), No. 11, pp. 859–870*).

Determination of different kinds of sugar, A. Bornträger (*Staz. Sper. Agr. Ital., 30, p. 325; abs. in Bul. Soc. Chim. Paris, 3. ser., 18 (1897), No. 23, p. 1280*).—The polarimetric and gravimetric (Fehling-Soxhlet) methods were compared on different kinds of wine musts.

Determination of nitric acid in drinking water, Devarda (*Ztschr. Allg. Osterr. Apoth. Ver., 1897, p. 257; abs. in Vrtljschr. Chem. Nahr. u. Genussmtl., 12 (1897), No. 2, p. 273*).—Evaporate ½ to 2 liters of the water to be examined to about 300 cc., add 2 gm. of pulverized aluminum bronze (containing 59 per cent of aluminum, 39 per cent of copper, and 2 per cent of zinc), and 20 cc. of 30 per cent potash solution free from nitrate. Let stand ½ hour and distil off ammonia into acid with gentle heat.

A new method for the determination of phosphoric acid, Woy (*Ztschr. Öffentl. Chem., 3 (1897), p. 321; abs. in Analyst, 22 (1897), Dec., p. 333*).—Further remarks on the author's method which has already been noted (E. S. R., 9, p. 321). The reasons for the adoption of a 3 per cent molybdic solution are explained. Since certain chlorids interfere with the precipitation "the author dissolves raw phosphates in sulphuric acid (taking care to prevent the gypsum formed from settling into a mass), afterwards neutralizing the portion of the solution taken with ammonia as far as is possible without causing a precipitate to fall."

Some new forms of apparatus, A. E. Knorr (*Jour. Amer. Chem. Soc., 19 (1897), No. 10, pp. 817–820, figs. 3*).—Illustrated descriptions of an automatic filtering siphon, and a new form of gas generator.

Some products of the tuberculosis bacillus, E. A. de Schweinitz and M. Dorset (*Jour. Amer. Chem. Soc., 19 (1897), No. 10, pp. 782–785*).

Washing bottle for gases, S. FAMULARI (*Abs. in Jour. Chem. Soc.* [*London*], *72* (*1897*), *No. 421, II, p. 548*).

Report of the chemist, W. B. HARDIN (*South Carolina Sta. Rpt. 1896, pp. 34–38*).—A brief summary of the work of the year in the department of chemistry, including analyses of sweet potatoes (see p. 754), cañaigre, and fertilizers.

BOTANY.

Experimental investigations on the assimilation of ammoniacal and nitric nitrogen by the higher plants, E. LAURENT, E. MARCHAL, and E. CARPIAUX (*Bul. Acad. Roy. Sci. Belg., 3. ser., 32* (*1896*), *pp. 815–865; abst. in Bot. Centbl., 70* (*1897*), *No. 6–7, pp. 232–235*).—The ability of some of the cryptogamous plants to assimilate nitric and ammoniacal nitrogen without the intervention of light has been shown by various authors. In this paper it is shown that the ability to assimilate these substances is not confined to the lower organisms, but is possessed by the higher plants under certain conditions. Leaves and stems, both green and etiolated, of potato, asparagus, barley, beets, elm, maple, and Aspidistra were experimented with, 4 lots of each being taken for the different portions of each experiment. The details of the methods of analysis and of the experiments are fully given.

As a result of the experiments it was found that the higher plants require light and particularly the ultra-violet rays for the assimilation of nitrates and ammonia salts and the formation of organic nitrogenous compounds.

Chlorophyll is not necessary for this assimilation, although it greatly facilitates the assimilation of nitric nitrogen. Etiolated plants readily assimilate ammoniacal nitrogen, in fact better than green leaves.

In the assimilation of nitric nitrogen, intermediate products intervene.

It appears that light is not only necessary to the higher plants for the production of energy for the synthesis of the carbohydrates, but also for the production of albuminoid substances.

On the absorption of organic matter by roots, J. LAURENT (*Compt. Rend. Acad. Sci. Paris, 125* (*1897*), *No. 22, pp. 887–889*).—The author has made a study of the absorption of glucose and inverted sugar by maize plants grown in water cultures. Before placing the grains of corn to sprout they were thoroughly sterlized, and after sprouting they were suspended in various culture media. The plants grew readily, some of the specimens flowering while growing in the solutions.

Various amounts of glucose and inverted sugar were introduced into the cultures and the plants were found to absorb amounts of these substances about in proportion to their weight. In some cases the absorption was out of proportion, but these were explained by having been larger seed, hence more reserve material at the disposal of the plant.

The saccharine materials absorbed were utilized and a great part given off in the form of carbon dioxid, since the amount absorbed in some cases exceeded the total dry weight of the plant.

Some considerations upon the functions of stomata, C. E. BESSEY (*Science, n. ser., 7 (1898), No. 158, pp. 13-16*).—This paper was read before Section K of the British Association for the Advancement of Science, August, 1897. The author's conclusions are as follows:

"(1) One of the functions of stomata is the admission of carbon dioxid to the chlorophyll-bearing tissues of the plant, for use in the formation of the carbohydrates.

"(2) The loss of water by terrestrial plants was originally hurtful, and is so now in many cases.

"(3) If plants have utilized this constant phenomenon it is for the supply of food matters of secondary importance, as the salts in solution in the water of the soil."

On the formation of fats in seeds and fruits, C. GERBER (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 19, pp. 732-735*).—The author, from his experiments with olives, castor beans, peach and sweet-almond pits, concludes, with Müntz and Leclerc du Sablon, that the oils are formed in the seed or fruit from the carbohydrates present, particularly from the glucoses. In this he differs with Mesnard, who holds that only the chlorophyll-bearing cells can form oils, which in turn are carried to the reserve cells in the fruit or seed.

Influence of various substances added to water cultures and of oxygen on the formation of chlorophyll, W. PALLADIN (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 21, pp. 827-829; also Rev. Gén. Bot., 9 (1897), No. 107, pp. 385-394*).—Etiolated plants of *Vicia faba* and *Phaseolus vulgaris*, after being kept in the dark for 48 hours, were brought into the light and various substances added to the water cultures, the effect of such substances on chlorophyll production being noted. The author states that chlorophyll formation was favored when saccharose, raffinose, glucose, fructose, maltose, glycerin, galactose, lactose, and dextrose were added to the culture media. Inulin and tyrosin seemed without any appreciable effect, while chlorophyll production was checked by mannite, dulcite, asparagin, urea, alcohol, ammonium chlorid, and quinic acid.

Experiments in which the effect of lack of oxygen was noted show that during the formation of chlorophyll it is necessary that more oxygen be given the plants than the amount which they evolve through respiration.

The details of the experiment are fully given in the second publication noted.

Plant growth with and without argon, T. SCHLÖSSING, Jr. (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 19, pp. 719-722*).—The author reports on a series of experiments conducted with oats and *Holcus lanatus* grown in artificial atmosphere in which the argon content was regulated. It was found that argon does not play any important rôle in plant growth.

Report upon preliminary experiments with the Röntgen rays on plants, G. F. ATKINSON (*Science, n. ser., 7 (1898), No. 158, pp. 7-13, pl. 1*).—The author reports 12 series of experiments to test the effect of Röntgen rays on the growth of plants. A large number of phanerogams were experimented with, the plants being grown in various conditions of light. In different experiments plants were experimented with from the seedling stage to rather more mature condition. In addition to the flowering plants, experiments were conducted with 3 species of Mucor, some chromogenic bacteria, a motile bacillus, and a species of Oscillatoria. In the various experiments it was seen that the plant tissues absorbed the Röntgen rays quite freely, but there was no marked influence on the growing parts. There were no visible external injuries, even when the plants were exposed at close range for the greater part of the time during several days.

Report of the botanist, C. E. BESSEY (*Nebraska State Bd. Agr. Rpt. 1896, pp. 79–93*).—The author reports on the progress of the botanical survey of the State of Nebraska, and states that now more than 3,200 species of plants are known to be natives of the State. Popular notes are given on pasture, hay, fodder, and silage plants; root and soiling crops; and grains. The culture and use of alfalfa, considered "without question the great forage plant of the Plains," are noted at length.

Report of the botanist and microscopist for 1891, C. F. MILLSPAUGH (*West Virginia Sta. Rpt. 1891, pp. 41–47*).—A brief report of the work of the botanical department of the station for the year 1891.

Report of the botanist, H. L. BOLLEY (*North Dakota Sta. Rpt. 1896, pp. 22–32, figs. 5*).—A brief statement of the work accomplished during the year.

Sylloge Fungorum, P. A. SACCARDO (*Vol. 12, pt. 2, No. 1, pp. 642*).—Alphabetical list of hosts with parasitic fungi. The present number includes host of species A to K.

Natural selection, E. HAECKEL (*Natürliche Schopfungs-Geschichte, etc. Berlin: Georg Reimer, 1897, 9. ed., pt. 2, pp. 831*).—Treats of evolution in general and especially of the theories of Darwin, Goethe, and Lamarck.

Some problems of acclimatization in Russia, N. DE ZOGRAF (*Rev. Sci.* [*Paris*], *4 ser., 8 (1897), No. 24, pp. 744–748*).

Introduction to structural botany, flowerless plants, D. H. SCOTT (*London: Black, 1897, 2. ed., pp., 116*).

Concerning the theory of protoplasm and cell structure, A. KOBELT (*Naturw. Wchnschr., 12 (1897), No. 48, pp. 566–574*).

Concerning two free citric acid forming fungi, C. WEHMER (*Chem. Ztg., 21 (1897), No. 98, pp. 1022, 1023, fig. 1*).—Describes apparatus for cultures of the fungus and gives the transformations brought about by it.

Assimilation of nitrogen through the agency of root tubercles in certain Papilionaceæ (*Agr. Ledger (Agr. ser., No. 8), 1894, No. 7, pp. 12*).—A popular résumé of the subject, with some additional notes by the editor and others.

Action of gravity on the growth of some fungi, J. RAY (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 14, pp. 500, 501*).—Cultures of *Sterigmatocystis alba* grown on a vertically revolving wheel seem to indicate that gravity retards the growth of that fungus.

Concerning the fruiting and development of the oosphere in the Peronosporeæ, A. N. BERLESE (*Jahrb. Wiss. Bot.* [*Pringsheim*], *31, (1897), No. 2, pp. 159–196, pls. 4*).

Concerning the distribution of pentosans in plants, A. VAN KETEL (*Ber. Nederland. Maatschap. Bevord. Pharm., 1897, p. 730*).

Mycorrhiza of Ophyris aranifera, DANGEARD and L. ARMAND (*Rev. Mycol., 20 (1898), No. 77, pp. 13–18, pl. 1*).

Concerning the mycorrhiza of orchids, WARLICH (*Rev. Mycol., 20 (1898), No. 77, pp. 1–10, pl. 1*).

The mycorrhiza of Listera cordata, R. CHODAT and A. LENDNER (*Rev. Mycol., 20 (1898), No. 77, pp. 10-13, pl. 1*).

Proof of smoke injury to plants as shown by chemical analysis, VATER (*Tharand. Forst. Jahrb., 47 (1897), No. 2, pp. 254-263*).

How is the high content of iron or iron oxid in the ash of Trapa natans to be accounted for? G. THOMS (*Landw. Vers. Stat., 49 (1897), No. 3, pp. 165-171*).

ZOOLOGY.

Some common birds in their relation to agriculture, F. E. L. BEAL (*U. S. Dept. Agr., Farmers' Bul. 54, pp. 40, figs. 22*).—The food habits and economic importance of cuckoos (*Coccyzus americanus* and *C. erythrophthalmus*) are discussed. The cuckoos are preeminently insectivorous. In 16 stomachs of the black billed cuckoo, 328 caterpillars, 11 beetles, 15 grasshoppers, 635 flies, 3 stink bugs, and 4 spiders were found, as well as a great mass of material too badly broken up to be recognized. In 21 stomachs of the yellow billed cuckoo, collected from May to October, there were found 355 caterpillars, 18 beetles, 23 grasshoppers, 31 sawflies, 14 bugs, 6 flies, and 12 spiders. One stomach contained 12 American tent caterpillars; another, 217 fall webworms.

Like the cuckoos, the various woodpeckers are almost exclusively insectivorous, the redheaded woodpecker destroying large quantities of grasshoppers. What vegetable food they take consists largely of small fruits and berries, such as those of the dogwood, Virginia creeper, etc.

Fifty honeybees, of which 40 were drones, were found in the stomachs of 14 kingbirds. About 90 per cent of the food of the kingbird consists of insects, mostly of injurious species. The habit of preying upon honeybees is much less prevalent than has been supposed. What vegetable food it takes consists of wild fruits of little economic value.

An examination of 80 stomachs of the phœbe demonstrated that over 93 per cent of its animal food consists of insects and spiders, wild fruit constituting the remainder. Grasshoppers in season are eaten to a considerable extent, while wasps and many flies that annoy cattle, and bugs and spiders are eaten regularly.

As shown by an examination of 292 stomachs of the blue jay, 24 per cent of this bird's food consists of animal and 76 of vegetable matter. Some few remains of bird's eggs were found in 3 stomachs, and in 2 stomachs the remains of young birds. In the bird's annual bill of fare the author notes mites, fish, salamanders, snails, crustaceans, beetles, grasshoppers, caterpillars, etc. In 70 stomachs corn was found, in 8 wheat, in 2 oats, and in 158 mast.

The crow, notwithstanding some bad habits, is defended; and as far as possible so also is the rice bird. It is estimated that an annual loss of $2,000,000 to rice growers is caused by this bird, which, notwithstanding the annual slaughter to which it is subjected in the South, does not seem to decrease in numbers.

Of the red winged blackbird 725 stomachs were examined that showed vegetable food to the extent of 74 per cent. In 238 stomachs of the meadow lark 73 per cent of animal matter was found, which consisted in season largely of crickets and grasshoppers.

The Baltimore oriole is shown by an examination of 113 stomachs to feed largely (34 per cent) upon caterpillars. During its stay within the borders of the United States only about 16 per cent of its food consists of vegetable matter.

Of the crow blackbird 2,258 stomachs were examined, which showed that nearly one-third of its food consists of insects, and that it sometimes eats snails, crayfish, salamanders, small fish, and mice. Only 0.5 per cent of its food consists of the remains of birds and their eggs.

Several sparrows were examined, and while it is acknowledged that they are primarily seed eaters, it is noted that with 3 species—the song sparrow (*Melospiza* sp.), chipping sparrow (*Spizella socialis*), and field sparrow (*Spizella pusilla*)—at least about one-third of their food consists of insects.

The snowbird (*Junco hyemalis*), as shown by an examination of many stomachs, consumes daily about $\frac{1}{4}$ oz. of weed seeds. Assuming that the birds average 10 to each square mile and that they remain in their winter range 200 days, the snowbirds visiting Iowa consume 875 tons of weed seeds in a single season.

The rose breasted grosbeak is highly commended for the good it has done in destroying the potato beetle. Relative to the cliff swallow, the author claims that it is a mistake to tear down its nest, since it forms a picturesque rather than a disfiguring addition to a building.

The cedar bird, as shown by 152 stomachs, lives almost wholly (87 per cent) upon a vegetable diet which consists mostly of fruit. Only 13 per cent of its food consists of cultivated fruit. This amount was found in only 9 stomachs out of 41 examined during the months of June and July.

Two hundred and thirteen stomachs of the catbird showed that the proportion of vegetable to animal food is as 56 to 44. It is noted that it is only in the Western States, where trees are scarce, that the catbird is seen to any great extent about orchards and gardens.

The brown thrasher, as shown by an examination of 121 stomachs, eats a larger proportion (64 per cent) of animal food.

As shown by an examination of 52 stomachs, the house wren lives almost wholly (98 per cent) upon insects. On the other hand, according to an examination of 330 stomachs, the animal food of the robin amounts to only 42 per cent. Of the 58 per cent of vegetable food, 47 per cent consists of wild fruits.

The food of the bluebird, as shown by an examination of 205 stomachs, consists of 76 per cent of animal and 24 per cent of vegetable matter. In the former there were found 28 per cent of beetles, 22 of grasshoppers, and 11 of caterpillars. Besides, there was a large number of spiders. During the months of August and September grasshoppers are eaten to the extent of 60 per cent of the birds' food.

The food of native birds, W. BAER (*Ornith. Monatsber., 3. ser., 5 (1897), No. 8, pp. 125–127*).

The agency of man in the distribution of species, L. O. HOWARD (*Nature, 56 (1897), No. 1460, pp. 604, 605*).—This is the author's vice-presidential address before the American Association for the Advancement of Science.

Elements of comparative zoology, J. S. KINGSLEY (*New York: Henry Holt & Co., 1897, pp. 357, figs. 146*).—This is an elementary work for high-school and college students, and has the advantage of combining the valuable features of a laboratory guide with an elementary text-book. The figures illustrating representatives of the various orders of the animal kingdom or points in anatomy form an excellent feature, although a new one as laboratory manuals go. Considerable stress is laid upon the value of leading questions in drawing out the student's powers of observation and impelling him to form for himself the conclusions reached by others only after long and patient study. In the same way his comparative faculties are exercised. When he has finished the work the student should have a very fair elementary knowledge of the structural features of most of the orders of the animal kingdom. Under the head of comparative physiology a very brief summary of the chief animal functions is given. An equally brief chapter on the morphology of animals deals with the development of animals, dimorphism, metamorphoses, etc. In a chapter on the animal kingdom it is endeavored briefly to bring out the distinguishing features of plants and animals. An appendix deals with reagents.

METEOROLOGY.

Meteorological observations, J. E. OSTRANDER, J. L. BARTLETT, and A. C. MONAHAN (*Massachusetts Hatch Sta. Met. Buls. 103–108, pp. 4 each*).—The usual summaries of observations and notes on the weather during July–December, 1897. In addition No. 108 gives an annual summary for 1897, the principal data in which are as follows:

Pressure[1] (inches).—Maximum, 30.88, March 1; minimum, 29.12, November 9; mean, 30.01. *Air temperature*[2] (degrees F.).—Maximum, 91.5, September 10; minimum, —11, February 1; mean, 46.6.; mean sensible (wet bulb), 43.7; annual range, 102.5; maximum daily range, 47.0, October 4; minimum daily range, 3.5, November 19; mean daily range, 20.6. *Humidity.*—Mean dew-point, 39.6; mean force of vapor, 0.402; mean relative humidity, 76.4 *Precipitation.*—Total rainfall or melted snow, 57.05 in.; number of days on which 0.01 in. or more rain or melted snow fell, 127; total snowfall, 52.8 in. *Weather.*—Mean cloudiness observed, 51.4 per cent; total cloudiness recorded by sun thermometer, 2,209 hours, or 50.5 per cent; number of clear days, 108; number of fair days, 109; number of cloudy days, 148. *Wind.*—Prevailing direction, W. or S. 79° W.; total movement, 54,220 miles; maximum daily movement, 400 miles, January 26 and February 3; minimum daily movement, 11 miles, February 1; mean daily movement, 146.8 miles; mean hourly velocity, 6.1 miles; maximum pressure per square foot, 22 lbs., 66 miles per hour on May 10. *Dates of frosts.*—Last, May 8; first, September 22. *Dates of snow.*—Last, April 27; first, November 12.

Meteorological observations, 1896, C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1896, pp. 288–290*).—Notes are given on the weather

[1] Reduced to freezing and sea level. The instruments are 2,735 ft. above sea level.
[2] Temperature in ground shelter 51 ft. below level of other instruments.

during the season, with monthly summaries of observations at Storrs on atmospheric pressure, rainfall, relative humidity, precipitation, and cloudiness, and a record of rainfall at 20 other places in the State during the 6 months ending October 31.

"The total precipitation for the year (40.6 in.), as measured at Storrs, was considerably below the average yearly rainfall for this State. The average for Connecticut from observers having records covering more than 5 years prior to 1896, as given by the New England Meteorological Society, is 48.5 in. The average at Storrs for the past 8 years is 44.2 in., and the average from 15 observers of the New England Meteorological Society in the State having records covering the 5 years prior to 1896 is 44.7 in. The rainfall was unusually large during the months of February and March, while April, May, and June gave an unusually small amount of rainfall. The rainfall throughout the remainder of the growing season was sufficient to keep up a fair growth of nearly all crops. The drought early in the season was sufficiently severe to check the growth of grass and some garden crops, the hay crop being quite light.

"The temperature for January was much below the average, while February and March were about normal. The spring opened quite early, April and May being mild and favorable for farm work. The last damaging frosts in the spring occurred on the 1st and 2d of May. The summer season was notable for several periods of extremely high temperature. Most farm crops except hay made a very fair growth. A light frost occurred September 20, and the first killing frost on September 24, thus giving a growing period of 144 days after the last severe frost in the spring. The average growing season at this station for the past 8 years has been 145 days."

Report of the meteorologist, G. D. SWEZEY and G. A. LOVELAND (*Nebraska State Bd. Agr. Rpt. 1896, pp. 139-155, figs. 26*).—This is an account of a study during 1896[1] of the weather and climate of Nebraska in connection with the State Weather Service and in cooperation with the Weather Bureau of the United States Department of Agriculture.

"During the year the number of regular observers has been increased, additional instruments furnished, and an increased issue both of the monthly bulletins and of the weekly crop bulletins distributed to the public and to the press of the State. The number of observers reporting now is 136, the number of weekly crop correspondents during the past season was 215, and the issue of weekly crop bulletins was 1,000."

The temperature and precipitation are summarized for each month, charts showing the isothermal lines, the precipitation, and prevailing winds. A table gives an annual summary of the observations at the different stations on temperature, precipitation, snowfall, and cloudiness.

"The mean annual temperature for the State was 49.4, which is 1.4 above the normal. The lowest temperature was 22 below zero at Lodgepole, on the 27th of November, and the highest was 109, at Norman, on the 26th of July.

"The average total precipitation over the State for the year was 26.19 in., which is 2.86 in. above the normal. The greatest total precipitation was 47.78 in., at Sutton, and the least was 12.60, at Fort Robinson. The greatest local monthly precipitation was 13.77 in., at Rulo, in May. The total average snowfall was 24 in. It was greatest in the northwestern section, where it was 36.4 in., and least in the southern sections, being 16.9 in. in the southwestern and 17 in. in the southeastern. The greatest amount of snow reported was 58 in., at Lodgepole, and the least 0.7 in., at Aurora.

[1] See also Nebraska Sta. Bul. 46 (E. S. R., 8, p. 964).

"The average number of days on which the precipitation amounted to 0.01 of an inch or more was 61, the maximum number being 109, at Omaha.

"The average velocity of the wind over the State for the year was 9 miles an hour, which is 0.5 of a mile an hour above the normal. The maximum velocity was 80 miles an hour at Lincoln on May 12."

The weather (*Ontario Bureau Ind. Rpt. 1896, pp. 38–44*).—Tables give the highest, lowest, mean highest, mean lowest, and mean temperature at the principal stations (8) in Ontario during each month of 1896 and during the period 1882–'96, as well as the annual means; monthly summaries of sunshine observations for the same periods at 5 stations; rainfall and snow during 1895 and 1896 at 71 places; averages for 7 years of temperature, atmospheric pressure, humidity, temperature of dewpoint, cloudiness, direction and velocity of wind, precipitation, etc., at Toronto Observatory; and a monthly and annual summary of observations on temperature, direction and force of wind, and precipitation at Haileybury, Lake Temiscamingue.

Meteorological observations, W. B. Alwood (*Virginia Sta. Rpt. 1896, pp. 8, 9*).—Tables give monthly summaries (1) of observations on temperature, precipitation, prevailing winds, and cloudiness during the year ending June 30, 1896; and (2) of maximum, minimum, and average temperature and precipitation for the period from June 30, 1893, to June 30, 1896.

Meteorology in Norway, 1896 (*Aarsber. Offent. Foranst. Landbr. Fremme, 1896, pp. 535–554*).

Temperature and rainfall, E. F. Ladd (*North Dakota Sta. Rpt. 1896, p. 13*).—A table gives maximum, minimum, and mean temperature and rainfall during each month of 1896 and for comparison the total rainfall of 4 previous years.

Certain agriculturally important temperature values of northern Southwest Africa, K. Dove (*Ztschr. Trop. Landw., 1 (1897), Nos. 11, pp. 271–274; 12, pp. 309–312*).

WATER—SOILS.

Experiments on the nitrification of the nitrogenous matter of the soil and of various nitrogenous fertilizers, P. Bonâme (*Rap. An. Sta. Agron.* [*Mauritius*], *1896, pp. 74–85*).—These experiments consisted in collecting the drainage water from soil to which different fertilizers had been added, and testing it for ammoniacal and nitric nitrogen at stated intervals (every month). Three series of experiments are reported. The first, extending from January 20 to June 26, 1896, was made with galvanized iron pots containing 16 kg. of soil. The second, extending from March 9 to June 13, 1896, was made in the laboratory with glass cylinders holding 900 gm. of soil. The third, extending from June 11, 1896, to February 20, 1897, was made with galvanized iron cylinders holding 3 kg. of soil.

The soil used consisted principally of fine sand (46.3 per cent) and clay (25.5 per cent), and contained 0.115 per cent of phosphoric acid, 0.155 per cent of lime, 0.066 per cent of potash, 13 per cent of oxid of iron and alumina, and 0.35 per cent of nitrogen. Like most of the soils of Mauritius it was poor in lime, and although it contained a considerable amount of organic nitrogen it was not very productive, because nitrification went on in it very slowly.

The nitrogenous fertilizers tested in different cases were sulphate of ammonia (20.5 per cent of nitrogen), dried blood (13 per cent), oil cake (6.1 per cent), fertilizer (5.4 per cent), and fish guano (6.8 per cent). In duplicate tests of sulphate, blood, and oil cake 5 per cent of calcium carbonate (in form of ground calcareous sea sand) and 1 per cent of lime (50 per cent caustic lime) were applied in addition to the nitrogenous fertilizers. The results are tabulated in full for each experiment.

The results obtained in the last series of experiments, which is probably the most complete, were as follows:

Amounts of nitric nitrogen in 100 grams of soil at different dates.

	June 11.	July 12.	Aug. 14.	Sept. 15.	Nov. 26.	Feb. 20.
	Mg.	*Mg.*	*Mg.*	*Mg.*	*Mg.*	*Mg.*
Ordinary soil	4.2	5.0	5.0	8.3	8.0	8.0
Soil with calcium carbonate	6.2	7.3	6.0	10.0	10.0	11.0
Soil with lime	17.0	20.0	19.0	24.0	28.0	28.0
Soil with ammonium sulphate	22.0	29.0	35.0	44.0	51.0	85.0
Soil with ammonium sulphate and calcium carbonate	75.0	133.0	136.0	190.0	187.0	188.0
Soil with dried blood	66.0	74.0	85.0	88.0	101.0	101.0
Soil with dried blood and calcium carbonate	123.0	151.0	159.0	158.0	174.0	178.0
Soil with oil cake	59.0	82.0	95.0	101.0	139.0	155.0
Soil with oil cake and calcium carbonate	97.0	139.0	137.0	148.0	155.0	166.0
Soil with fertilizer	64.0	90.0	111.0	127.0	140.0	145.0
Soil with fish guano	74.0	110.0	113.0	137.0	161.0	164.0

In unlimed soil in all cases sulphate of ammonia nitrified more slowly than the other fertilizing materials, the order of nitrification standing as follows: Fish guano (most rapid), fertilizer, oil cake, blood, and sulphate of ammonia. The addition of lime, especially of caustic lime, increased nitrification to a marked extent in both the fertilized and unfertilized soil, although its action was more energetic on the nitrogen of the fertilizers than on that of the soil. The slowness of nitrification of the sulphate of ammonia appeared to be due to a deficiency of salifiable bases in the soil, since on the addition of lime the sulphate readily nitrified. The other substances used had an advantage over the sulphate of ammonia in that the nitrogen in them was associated with more or less of salifiable bases.

The results indicate in general that in soils well supplied with lime, in a climate such as that of Mauritius, there is not as much difference in the assimilability of the different fertilizers tested as has often been supposed. They also emphasize the importance of lime in rendering the nitrogen of the soil available.

The mechanics of soil moisture, L. J. BRIGGS (*U. S. Dept. Agr., Division of Soils Bul. 10, pp. 24, figs. 7*).—This bulletin presents "the application of certain dynamical principles to the problems attending the movement and retention of soil moisture." A technical discussion is given of the following topics: Properties of water affecting its retention and movement in the soil—gravitation of water, surface tension, viscosity, and hygroscopic state; properties of films—pressure of a film and surface of no pressure; form of water surface between two soil grains; establishment of equilibrium between two unequal masses of capillary water; salts as affecting the movement of water in soils; temperature as affecting the movement of water in soils; influence of texture and structure of soils on the acquirement and retention of soil moisture; and displacement of capillary water through gravitation.

The water of the soil is considered to be of three kinds: Gravitation water, capillary water, and hygroscopic water. These are defined and the forces and principles involved in their movement and retention are illustrated on the assumption that the soil is made up of spherical particles arranged in different ways.[1] The two great factors in determining the movement and retention of soil water, gravitation and surface tension, are given first attention, a clear distinction being drawn between surface tension and the effective force of a film; and then the modifying influences of viscosity and hygroscopicity are considered.

"With the exception of mercury, water possesses a higher surface tension than any other substance which is liquid at ordinary temperatures. The surface tension of water[2] expressed in dynes per centimeter is 75.6 at 0° C. and 72.1 at 25°. The temperature coefficient is thus about —0.14 dynes per degree Centigrade. The surface tension of most aqueous solutions of salt is higher than that of water, and the surface tension increases with the concentration of the solution, as is shown in the following table:

Surface tension of solutions of salts in water.

Salt in solution.	Density.	Concentration. *a*	Temperature.	Surface tension.
			° *C.*	*Dynes per cm.*
KCl	1.170	25	15-16	82.8
KCl	1.101	15	15-16	80.1
KCl	1.046	7	15-16	78.2
NaCl	1.193	25	20	85.8
NaCl	1.107	15	20	80.5
NaCl	1.036	5	20	77.6
K_2CO_3	1.357	35	15-16	90.9
K_2CO_3	1.157	16	15-16	81.8
K_2CO_3	1.040	5	15-16	77.5
KNO_3	1.126	19	14	78.9
KNO_3	1.047	7	14	77.6
$MgSO_4$	1.274	24	15-16	83.2
$MgSO_4$	1.068	6	15-16	77.8

a Approximate weight of the dissolved substance in 100 parts by weight of the solution.

"It must be remembered, however, that the surface tension of solutions is very greatly decreased by the addition of very small quantities of certain organic substances produced through the decomposition of vegetable matter. This action is especially marked where there are present substances of an oily nature which do not go into solution, but spread out over the surface in an extremely thin film. Owing to such substances being continually produced by the decay of organic matter, the

[1] Soyka, Forsch. Agr. Phys. [Wollny], 18 (1895), p. 1; Whitney, Agr. Sci., 3 (1889), p. 199.

[2] Smithsonian Physical Tables, 1896, p. 128.

surface tension of the soil moisture is kept very low and could be only slightly influenced by the addition of salts. The application of substances to the soil for the purpose of changing its water content through a change in the surface tension would not, therefore, necessarily be productive of marked results.

"If we take the viscosity[1] of water at 0° C. to be 100, the viscosity at 25° C. is 50, at 30° is 45, and at 50° about 31. This great variation in viscosity with change of temperature is illustrated in the flow of water through soils which King[2] found in his leaching experiments but failed to explain.

"The viscosity of gases in opposition to that of fluids increases with increase of temperature. Air, which is largely used in making so-called 'permeability' determinations of soils, has a viscosity of 0.00017 (1+.00273 t). An increase in temperature of 40° C. would therefore cause the coefficient of viscosity of air to increase one-tenth of its amount. This evidently should always be taken into consideration in determining the physical character of a soil."

Little is definitely known of the nature of the film which constitutes the hygroscopic moisture, and the author proposes to study the subject later.

"The one important factor which determines the acquirement and retention of soil moisture is the curvature of the capillary water surfaces. If equal volumes of 2 soils are placed in contact, and the curvature of the surface is less in the first than in the second, then water will move from the first to the second, increasing the curvature in one and decreasing it in the other until it becomes the same in both soils. If the second soil contains a greater number of capillary spaces than the first, it will contain more water when equilibrium is established. During the adjustment water will have actually moved from a soil containing a low percentage of water to one having a higher percentage. In no case, however, will water leave a capillary space having a water surface of large curvature to go to a space with a surface of less curvature. It is the form of the surface which determines the movement of the water."

Investigations on the temperature conditions of different kinds of soil, E. WOLLNY (*Forsch. Agr. Phys.* [*Wollny*], *20* (*1897*), *No. 1, pp. 133–186*).—This is a second contribution to this subject.[3] The previous paper related to the temperature conditions of humus, clay, and quartz-sand soils. The present article is devoted to the temperature conditions in calcareous, magnesian, and ferruginous soils, as determined by observations extending over a number of years. The results are reported in detail and indicate that calcareous and magnesian soils have a decidedly lower heating and cooling capacity than other mineral soils; *i. e.*, they are colder during warm periods and warmer during cold periods. The variations in temperature are also smaller in these soils than in others of mineral origin. As regards the influence of different forms of lime and magnesia, the results indicate that during the warmer half of the year soils containing gypsum are, as a rule, the warmest; those containing calcium carbonate standing next, and those containing magnesium carbonate being the coldest. The variations in temperature are smallest for the gypsum soil and greatest for the calcium carbonate soil. Crystallized calcium carbonate showed a greater

[1] Smithsonian Physical Tables, 1896, p. 136.

[2] U. S. Dept. Agr., Weather Bureau Bul. No. 5, p. 66.

[3] Forsch. Agr. Phys. [Wollny], 19 (1896), p. 305 (E. S. R., 8, p. 964).

warming and cooling capacity than precipitated carbonate. The mixing of calcium carbonate with other mineral constituents, clay, sand, etc., had the effect of lowering the soil temperature and reducing the temperature variations. Iron compounds exerted only a slight influence upon the temperature conditions of the soil.

Investigations on the influence of frosts on the temperature conditions of soils with different salt contents, R. ULRICH (*Forsch. Agr. Phys.* [*Wollny*], *20* (*1897*), *No. 1, pp. 218–229*).—In these investigations soil (fine kaolin) was mixed in cylinders with 0.05, 0.1, and 0.2 per cent of calcium hydroxid, sodium chlorid, potassium chlorid, calcium chlorid, potassium nitrate, sodium nitrate, potassium sulphate, magnesium sulphate, sodium phosphate (NaH_2PO_4), potassium phosphate (KH_2PO_4), potassium carbonate, sodium carbonate, and potassium hydroxid, and subjected to temperatures ranging from 0° C. to —10° C. The results show that the temperature of freezing was lowered by the addition of the salts—the larger the amount of salts present the greater the lowering of the temperature. When the soil water froze the temperature of the soil rose at once to 0° C., remained for a time at this point, and then gradually fell under the influence of low temperatures. Certain salts, such as calcium hydroxid, chlorid, and nitrate, retarded this fall of temperature; others, such as potassium hydroxid, phosphate, and carbonate, hastened it. The sulphates exerted no influence in this respect. This difference in behavior of the various salts is partly explained by their effect on the physical character of the soils. The hydroxids, carbonates, as well as the phosphates of the alkalies, make the soil more compact and thus increase its conductivity, while other salts, especially calcium hydroxid, have an opposite effect.

Soil moisture, E. F. LADD (*North Dakota Sta. Rpt. 1896, pp. 9–13*).—Monthly summaries (April to October) are given of weekly observations during 1892–'96 on soils at depths of from 1 to 3 and 5 to 7 in. Determinations of moisture in soils at two different places in the State where the Campbell method of soil culture was being tested are also reported, and results are tabulated of an experiment undertaken for the purpose of determining the influence of different methods of cultivation on soil moisture during drought. The methods of cultivation were as follows: (1) Ground kept free from growing weeds, but otherwise not disturbed; (2) surface cultivated to a depth of 1 in. every fourth day; (3) surface cultivated to a depth of 3 or 4 in. every fourth day; (4) ground rolled and then the surface stirred to a depth of 1 in. every fourth day; (5) mulched with dry straw manure, and weeds not permitted to grow. The results of this experiment are irregular and inconclusive and the investigation is to be continued.

Protection and improvement of worn soils, J. S. NEWMAN (*South Carolina Sta. Bul. 32, pp. 12, figs. 5*).—It is explained that the principal cause of the injury to the cultivated soils of the cotton States is surface washing, which is a result of the system of clean culture and hillside ditches commonly practiced. Terracing is recommended as "the most, and in fact the only, reliable means of preventing injurious surface washing upon cultivated hillsides," and directions are given for the construction of terraces.

The value of Bermuda grass in preventing washing of the soil and of green manuring in restoring the fertility of washed soil is briefly discussed.

"By a judicious rotation of crops, alternating nitrogen collectors and nitrogen consumers and clean crops with those which supply humus, rapid improvement in both the mechanical condition and the chemical contents of soils may be wrought. Growing renovating crops affords the only practicable means of broadcast manuring on a large scale in a country in which so few stock are kept as in the cotton belt. In our climate we can grow two renovating crops—peas and crimson clover—in one year. If peas are planted in the whole corn crop and follow small grain, renovation will be both certain and rapid."

The value of plant roots as tillers of the soil, R. H. Elliot (*Jour. Roy. Agr. Soc. England, 3. ser., 8 (1897), pt. III, pp. 467–477*).—In this paper the author discusses the action of roots in disintegrating the soil, their effect on the subsoil, and their direct manurial action as they decay.

The value of roots in maintaining the physical condition of the soil is pointed out. Attention is called to the fact that when land is first plowed up, either from the original turf or an old grass land, the soil is in the same condition as new forest soil, owing to the numerous roots which penetrate it, and that the decline of its fertility is not apparent until this matter has become exhausted, causing the soil to solidify and to become tough and shallow, the physical conditions having been so changed that the land has become a poor medium for plant growth.

In connection with the discussion on the action of roots as subsoiling agents, several examples are given as illustrations. On his own place the author found that chicory penetrated apparently with little difficulty a hardpan about 1 ft. thick and 14 in. below the surface. The roots of burnet and kidney vetch had gone about 20 in., but the alfalfa roots only from 8 to 10 in. It was observed that the strong roots of chicory and burnet had disintegrated the hardpans with their laterals or off shoots. The author considers cropping and drainage the means by which humus is partly consumed and partly washed out of the soil and the protection of a turf composed of deep and strong rooting plants which at once disintegrate the soil and till it to its lowest possible depth the means by which humus can be most profitably restored. By comparing the results obtained from 2 fields after each field had been sown with a mixture of grass, clovers, and deep-rooting plants like chicory and burnet, it is shown that an inferior soil, with no manure other than that of a good turf, and which had never been dressed with barnyard manure, is capable of approximating in yield the best land which has been aided by barnyard manure from time immemorial.

The fruit soils of Oregon, G. W. SHAW (*Oregon Sta. Bul. 45, pp. 76–90*).—A discussion of the soils of Oregon from a chemical standpoint. The soils of the eastern, or arid, part of the State differ considerably from those of the humid part and the soils of the southern part of western Oregon differ from those of the Willamette Valley, as shown by the following table:

Lime, potash, and phosphoric acid in Oregon soils.

	Willamette Valley.	Southern Oregon.	Eastern Oregon.
	Per cent.	*Per cent.*	*Per cent.*
Lime	0.83	2.22	1.22
Potash	.23	.34	.43
Phosphoric acid	.21	.13	.14

The author also discusses alkali soils and means of reclaiming them.

Report of the geologist, E. H. BARBOUR (*Nebraska State Bd. Agr. Rpt. 1896, pp. 157–172, figs. 11*).—This article reports mechanical analyses of subsoils from 10 different counties of Nebraska and of 3 samples of wind-blown dust, accompanied by a popular discussion of the following topics: Soil survey, soil regions, absorption of water, free water or ground water, capillary water, capillarity assisted and evaporation checked, dust blanket as a protection for soil moisture, hygroscopic water, absorption of storm waters, tendency of cultivation to catch and hold more moisture, desirability of catching and conserving every drop of rain, cracks and fissures in soil, relation of precipitation to imbibition in Nebraska soils, relation of precipitation to the growing season, importance of a moist soil, water needed by growing crops, protection of wind-breaks to plant and soil moisture, annual rainfall of Nebraska not increasing, and relation of irrigation to soils.

The average of the 10 analyses of subsoils is as follows: Moisture in air-dry sample, 3.77 per cent; organic matter, 3.51; gravel, 0.46; coarse sand, 1.04; medium sand, 5.67; fine sand, 15.80; very fine sand, 18.66; silt, 36.34; fine silt, 2.64; clay, 11.89 per cent.

A reconnoissance in southeastern Washington, I. C. RUSSELL (*Water Supply and Irrig. Papers, U. S. Geol. Survey, No. 4, pp. 96, pls. 7, figs. 3*).—This is a description of the geologic structure in and adjacent to the drainage basin of the Yakima River, Washington, and the great plains of the Columbia to the east and south of this area, covering areas in southeastern Washington, northeastern Oregon, and adjacent portions of Oregon. "The region, though not arid, depends for its development upon more complete methods of utilizing the water supply, and this in turn rests upon a thorough knowledge of the underground structure. The latter therefore has been examined and described at some length, as preliminary to a discussion of the employment of the water resources." Special attention is given to the occurrence of artesian waters.

Artesian well waters, E. F. Ladd (*North Dakota Sta. Rpt. 1896, pp. 14, 15*).—Determinations of the total solids, organic matter, and mineral constituents of 5 samples of artesian well water are reported.

Chlorin in rain water (*Agr. Students' Gaz., 8 (1897), No. 5, p. 152*).—"The rainfall [at Cirencester] for the 6 months ending September 30 was 16.35 in., falling on 87 days; the rain contained as a mean chlorids equivalent to 0.243 grains of sodium chlorid a gallon, that is a total deposit of 12.77 lbs. of common salt per acre. For the 12 months ending at the same date the total rainfall was 33.09 in. on 186 days, and the chlorids equivalent to 30.88 lbs. of common salt per acre."

The amount of nitrogen conveyed by red clover to different kinds of soil, N. Passerini (*Bol. Scuola Agr. Scandicci, 3 (1895), pp. 102–111; abs. in Jour. Chem. Soc. [London], 72 (1897), No. 421, II, p. 587*).—Box experiments were made with sandy, clayey, and calcareous soils. Only in case of the latter was there a gain of nitrogen, indicating that green manuring is not likely to be successful in soils poor in lime.

On the improvement of humus soils, F. Dumont (*Jour. Soc. Agr. Brabant-Hainaut, 1897, No. 42*).

FERTILIZERS.

The preservation of nitrogen as well as the transformation of different forms of nitrogen in barnyard manure, W. Schneidewind (*Jour.-Landw., 45 (1897), No. 2, pp. 173–202; Chem. Ztg., 21 (1897), No. 81, p. 841*).—It is stated that numerous laboratory experiments tend to show that under certain conditions the amid and ammonium compounds of manure are rapidly lost in the form of ammonia, but that an appreciable loss of nitrogen in the free state occurs only when nitrates are present. The addition of marl reduced the loss of nitrogen from 22.6 to 9.9 per cent, and the use of marl and peat reduced it to 6.1 per cent. It is believed that in the majority of cases the nitrogen is lost principally in the form of ammonia, although in special cases the loss of free nitrogen may exceed that of nitrogen as ammonia.

Investigations on the decomposition of nitrates gave the following results: The addition of water increased the decomposition of nitrates; nitrates decomposed more slowly in old manure than in fresh; increasing the amount of manure applied to a soil increased the amount of nitrates decomposed. In vegetation experiments with soils to which straw and manure poor in nitrogen were applied considerable amounts of nitrates were transformed, part of the nitrogen escaping in the free state and part going into organic combinations.

For the preservation of manure the author thinks attention to the construction, packing, and moisture of the manure heap of more importance than the use of preservatives. Of the latter the most effective seem to be sulphuric acid, sodium bisulphate, calcium carbonate, and caustic lime. The first 2 are effective in preventing all loss of nitrogen when used in sufficient amounts to give an acid reaction (0.4 to 1 per cent in case of sulphuric acid), but they are not recommended, because they may be injurious to the animals and interfere with the rotting of the manure. Sulphuric acid favors the formation of ammonia from the organic nitrogen, but caustic lime has an opposite effect.

The latter checks fermentation and reduces loss of nitrogen by favoring the conversion of ammonia not only into organic combinations but into nitrates, an appreciable amount of which is found in manure treated with lime. Calcium and sodium carbonates acted like caustic lime, but were not so effective.

It is claimed that the principle of preservation should be to conserve the organic and ammoniacal nitrogen as such, or by the use of preservatives to transform these forms of nitrogen into nitrates under conditions unfavorable to the activity of denitrifying bacteria. It is also stated that analysis will not decide the relative merits of different methods of preservation, but that vegetation experiments are necessary for this purpose.

Commercial fertilizers and chemicals, R. T. NESBITT and G. F. PAYNE (*Georgia Dept. Agr. Bul. 33, pp. 116*).—This is a report of the fertilizer inspection in Georgia for the year ending June 30, 1897, and includes texts of the various State laws relating to fertilizers, with regulations adopted by the commissioner in accordance with them; notes on valuation; a compilation of analyses of ordinary fertilizing materials; statistics of the consumption of fertilizers in the United States in 1896; suggestions regarding the functions of fertilizers and the profitableness of their use; replies to correspondence relating to various fertilizer questions; notes on the percentage of nitrogen in sea island and upland cotton-seed meal, and tabulated analyses of 1,054 samples of fertilizing materials, including mixed fertilizers, cotton-seed meal, potash salts, phosphates, and other unmixed materials. The amount of fertilizers inspected during the season was 401,979.1 tons, as compared with 335,617.8 tons in the season of 1895–'96. The average composition of the fertilizers analyzed was: Available phosphoric acid 10.87 per cent, ammonia 2.25 per cent, and potash 2.21 per cent.

The following data of the consumption of fertilizers in the United States in 1896 were obtained by correspondence with the various State authorities:

Consumption of commercial fertilizers in the United States in 1896.

State and Territory.	Tons.	State and Territory.	Tons.
Georgia	335,617	Connecticut	20,000
South Carolina	199,497	Kentucky	19,550
North Carolina	185,000	Tennessee	19,445
Virginia	171,704	Vermont	13,000
New York	150,000	Louisiana	10,051
Pennsylvania	150,000	Utah (estimated)	5,530
Alabama	100,000	Missouri	2,000
Indiana	50,000	Wisconsin	200
Ohio	46,000	Oregon	60
West Virginia	39,350	Arizona	50
Mississippi	32,000		
Florida	26,588	Total	1,575,642

Fertilizer inspection, C. D. WOODS and J. M. BARTLETT (*Maine Sta. Bul. 38, pp. 32*).—This bulletin gives a summary of the provisions of the State fertilizer law, a list of manufacturers complying with the law in 1897, and tabulated analyses of 30 samples of fertilizers furnished by manufacturers[1], and 142 samples collected in the open market by a representative of the station.

"The figures which are given as the percentages of valuable ingredients guaranteed by the manufacturers are the minimum percentages of the guarantee. If, for instance, the guarantee is 2 to 3 per cent of nitrogen, it is evident that the dealer can not be held to have agreed to furnish more than 2 per cent, and so this percentage is taken as actual guarantee. The figures under the head of "found" are those showing the actual composition of the samples. . . .

"It is gratifying to note that, as a rule, the fertilizers sold in the State are well up to the guarantee. In a few instances the particular lots of fertilizers sampled are not quite as good as they should be; there is, however, no case which appears to be an attempt to defraud. The comparisons indicate that the manufacturers do not intend to do much more than make good the minimum guarantee and this is all that the purchaser can safely expect."

Treatise on fertilizers for practical farmers, A. STUTZER (*Leitfaden der Düngerlehre für praktische Landwirthe. Leipsic: Hugo Voight, 1897, 6. ed., pp. VII, 131*).

Treatise on fertilizers, A. CONRADI (*Düngerlehre. Berlin: Paul Parey, 1897, pp. 47*).

Treatise on fertilizers, E. VON WOLFF (*Düngerlehre. Berlin: Paul Parey, 1897, 13. ed., pp. VIII, 204*).—This is a revision of this standard work by J. H. Vogel.

A theoretical and practical treatise on fertilizers, F. LARVARON (*Traité théorique et pratique des engrais. Poitiers: Blanchier, 1897, pp. 224*).

Text-book on fertilizers for advanced agricultural and rural schools as well as for self-instruction, J. NESSLER (*Düngerlehre für Landwirthschafts und ländliche Fortbildungschulen, sowie zum Selbstunterricht. Bühl (Baden): Actiengesellschaft Konkordia, 1897, pp. 48*).

Concerning fertilizers and manures, G. L. TELLER (*Arkansas Sta. Bul. 47, pp. 101–118*).—A popular bulletin on this subject, a special feature of which is a discussion of the after effects of manure based on the experimental work at Rothamsted.

Manure and denitrifying bacteria, H. HITIER (*Jour. Soc. Agr. Brabant-Hainaut, 1897, No. 9*).

Barnyard manure and its economical management, F. G. DEISSMANN (*Der Stallmist und seine zweckmässige Behandlung. Prague: Fr. Haerpfer, 1897, pp. 24*).

Commercial fertilizers, their composition, preparation, and use, A. RÜMPLER (*Die käuflichen Düngestoffe, ihre Zusammensetzung, Gewinnung und Anwendung. Berlin: Paul Parey, 1897, 4. ed., pp. 248, figs. 32*).

Are the chemical substances used in the sterilization of human excrement injurious to agricultural plants and to the beneficial organisms of the soil? A. PETERMANN (*Ann. Sci. Agron., 1897, II, No. 1, pp. 120–135, figs. 2*).—See E. S. R., 9, p. 35.

The Tennessee phosphates, C. W. HAYES (*17th An. Rpt. U. S. Geol. Survey, pt. 2, pp. 513–550; abs. in Jour. Amer. Chem. Soc., 20 (1898), No. 1, Rev., p. 23*).—These phosphates "are classed as structural varieties of the 2 main types—the black and the white phosphates, the former originating in the deposition of a bed of phosphatic organisms in the Devonian Sea, while the latter is a secondary and essentially residuary deposit due to the differential solvent action of meteoric waters on phosphatic limestones. Anaylses are given only for the white phosphates, giving from 27.4 to 33.4 per cent of calcium phosphate ($Ca_3P_2O_8$)."

Fertilizer and vegetation experiments: Notes on experimental methods, H. HELLRIEGEL (*Düngungsversuch und Vegetationsversuch. Eine Plauderei über Forschungs-Methoden. Berlin: Paul Parey, 1897, pp. 19*).—This constitutes No. 24, 1897, of *Arb. Deut. Landw. Gesell.*

[1] Analyses of most of the manufacturers' samples were published in Bulletin 33 of the station (E. S. R., 9, p. 436).

FIELD CROPS.

Report of the agriculturist, J. H. SHEPPERD (*North Dakota Sta. Rpt. 1896, pp. 33–41, 48–51*).—The varieties of wheat tested at the station were obtained chiefly from the Northwest, but a number of them came originally from Russia. The sorts which have given the best results in yield and grade for 5 years are Experiment Station Fife, 774 Glyndon, and Red Fife.

Among the 30 varieties of oats, Black Beauty, Tartarian, Race Horse, Giant Yellow, and Archangel have given the best average yield in the variety test for 4 years.

Of 15 varieties of barley grown for 4 years, Manshury, Highland Scotch, Highland Chief, Champion of Vermont, and Chevalier produced the best average yields.

Mercer Flint and Minnesota Flint corn have ripened at the station for 3 years in succession and produced on an average for 2 years $37\frac{1}{2}$ and $34\frac{3}{4}$ bu. per acre, respectively. Flint corn is regarded as valuable for feed as dent corn. "The flint varieties usually ripen earlier and seem better adapted to northern climatic conditions than dent varieties."

Dwarf Essex Rape has produced good crops for the past 4 years.

Austrian brome grass (*Bromus inermis*) has been tried at the station and in several parts of the State and is the only new variety of grass which promises to be of particular value. Alsike and mammoth and red clovers yielded in 1896, 1,629, 2,270, and 2,275 lbs. of cured hay per acre, respectively.

The rotation of wheat with spring rye, barley, and oats showed little difference in the following wheat crops from those where wheat followed wheat continuously. Wheat grown after cultivated crops gave a greater percentage increase in yield over wheat grown continuously than wheat after summer fallowing, millet, timothy and clover, flax, field peas, or green manuring with peas and millet. A few plats were manured and planted to corn and the following season to wheat. A decided increase in yield of wheat resulted from the manure. A table showing the plan of the rotation experiments and the results is appended.

Influence of various amounts of nitrogen on the development of barley, D. N. PRYANISHNIKOV and S. M. KOUZNEZOV (*Izv. Moscow Sělskokhoz. Inst., 3 (1897), II, pp. 53–56*).—The plants were grown in pulverized white sandstone extracted with strong hydrochloric acid. A small amount of chalk was added to counteract any acid. The cylinders used were of glass and contained 3,800 gm. of sand. On the bottom of the cylinder a layer of broken glass was placed, into which was inserted a glass tube for watering. The humidity maintained was 60 per cent by weight of the maximum capacity of the sand for water, which corresponded to 570 gm. of water per pot. The following amounts of fertilizing materials were supplied as recommended by Hellriegel: 0.5168 gm. monopotassium phosphate, 0.2850 gm. muriate of potash, 0.4674 gm. magnesium sulphate, and 1.550 gm. calcium sulphate; and in addition nitrate of soda, which replaced the calcium nitrate usually employed, was supplied at the following rate: 7.752, 3.876, 1.938 (normal), 0.969, 0.484, 0.242, 0.121, 0.060 gm.

In each cylinder 3 grains of barley were planted June 15. Toward the end of June the plants of the first 3 groups (to which an abundance of nitrogen was supplied) were of a darker green color and more vigorous growth than those of the other groups. The first 3 groups headed out about a week and a half later than in the other groups. This effect of nitrogen was still more marked as regards the formation of the grain. While the plants provided with a moderate or insufficient amount of nitrogen ripened the beginning of September, the plants of the first 3 groups showed a tendency at the end of August to make a new growth without producing any grain. This of course was not exclusively the direct result of the excess of nitrogen, but was partially due to the retardation of maturity caused by this excess. The plants were harvested September 15. The yields were as follows:

Yields of barley receiving different amounts of nitrogen.

Experiment.	Amount of sodium nitrate applied.	Crop produced.				Length of plant.	Number of stems with heads.	Weight of 1 grain.
		Grain.	Other above ground parts.	Roots.	Total.			
	Grams.	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Cm.*		*Gram.*
Group No. 1	7.752	....	44.30	12.10	56.40	47.6	21	....
Group No. 2	3.876	....	53.00	16.30	69.30	55.2	25	....
Group No. 3	1.938	....	50.80	15.70	66.50	63.5	24	....
Group No. 4	.969	8.60	20.25	9.20	38.05	69.1	14	0.053
Group No. 5	.484	5.50	9.80	6.20	21.50	69.2	7	.054
Group No. 6	.242	3.45	6.00	4.10	13.55	59.6	6	.048
Group No. 7	.121	2.60	3.35	2.80	8.75	44.9	6	.041
Group No. 8	.060	1.60	2.85	2.25	6.70	38.9	6	.039

As regards the weight of the plants and the number of stems with heads the plants in experiment No. 2 gave bests results.

The percentage by weight of the roots in the total weight of the crops was as follows: No. 1, 21.4 per cent; No. 2, 23.5 per cent; No. 3, 23.7 per cent; No. 4, 24.2 per cent; No. 5, 28.8 per cent; No. 6, 30.3 per cent; No. 7, 32.2 per cent, and No. 8, 33.5 per cent. It appears, therefore, that the relative development of the roots increased as the conditions of growth in general became less favorable.

Analyses of the crop gave the following results:

Dry matter and nitrogen in the crop produced.

Experiment.	Dry matter.			Nitrogen.					
	In grain.	In other parts.	Total.	In grain.	In other parts.	Applied.	In dry matter produced.	Unconsumed.	
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Grams.*	*Grams.*	*Per ct.*
Group No. 1	....	50.58	50.58	....	2.22	2.558	1.120	1.433	56.0
Group No. 2	....	61.89	61.89	....	1.33	1.281	.820	.461	36.0
Group No. 3	....	58.03	58.03	....	.80	.643	.470	.173	26.9
Group No. 4	7.80	27.04	34.84	2.00	.43	.324	.272	.052	16.0
Group No. 5	5.00	14.66	19.66	2.09	.43	.164	.168	....	....
Group No. 6	3.20	9.13	12.33	1.85	.43	.085	.097	....	....
Group No. 7	2.40	5.71	8.11	1.50	.50	.045	.063	....	....
Group No. 8	1.50	4.66	6.16	1.46	.51	.025	.044	....	....

Where no grain was produced the stalks and leaves contained large amounts of nitrogenous matter.—P. FIREMAN.

Soil inoculation for leguminous plants, J. F. DUGGAR (*Alabama College Sta. Bul. 87, pp. 459–488, figs. 12*).—Inoculation experiments with a number of legumes were conducted on various soils in the field and the greenhouse. A discussion of nitrogen-collecting plants, the function of root tubercles, methods of soil inoculation, and the value of winter-growing legumes is given.

October 17, 1896, 4 fortieth-acre plats were sown with seed of hairy vetch. The soil was very poor, but was fertilized at the rate of 400 lbs. per acre of acid phosphate and 120 lbs. per acre of sulphate of potash, no nitrogen being applied. Two of the plats were inoculated. "The seed was dipped in water in which there had been stirred and allowed to settle earth from a lawn once a garden spot where common vetch (*Vicia sativa*) had for several years in succession made a thrifty growth." All plats were cut May 20, 1897. The yields of only 2 plats are given—the uninoculated plat yielded per acre 900 lbs. of green forage, which made 232 lbs. of cured hay, and the inoculated plat produced 9,136 lbs. of green forage per acre, giving 2,540 lbs. of cured hay. The soil of the inoculated plat was left in a better mechanical condition than the soil of the other plat.

Pot experiments were made in the greenhouse with hairy vetch, Canada field peas, crimson clover, alfalfa, white lupine, lespedeza, and cowpeas. The soil for these experiments was taken from an upland rocky cotton field which had been cleared about 20 years, a sandy cotton field cleared about 5 years, a woodland, a lespedeza pasture, and a cowpea field. Special germ fertilizers were used for inoculation in some of the experiments, but the inoculating material for cowpeas consisted of soil taken from around old cowpea roots, and that for lespedeza of soil from the lespedeza pasture. Hairy vetch and crimson clover were inoculated with clover Nitragin, Canada field peas with vetch Nitragin, and white lupines with lupine Nitragin. Alfalfa was inoculated with dust from the seed of bur clover (*Medicago maculata*). The organisms adhering to the perfectly dry bur clover seed had retained their vitality from the time of harvesting in May or June until late in the following October. The cost of inoculating with Nitragin is estimated at $2.20 per acre. The results of all the experiments are tabulated in an appendix.

Among others, the author makes the following summaries:

"Inoculation with the germ fertilizer or Nitragin greatly increased the yields of all these plants as compared with untreated plants. This increase in the weight of inoculated plants, after thorough drying, was as follows: Hairy vetch, 89 per cent; Canada field peas, 138 per cent; crimson clover (young plants), 146 per cent. Germ fertilizer prepared for vetch was effective on Canada field peas. Inoculation material procured without cash outlay acted like Nitragin and greatly increased the yields of hairy vetch and alfalfa.

"Soil from a field where a given leguminous plant has recently been successfully grown is an effective inoculating material for the same kind of plant when first sown in a soil not already naturally supplied with the required form of germ life.

"The dust adhering to the seed of bur clover was an effective inoculating material for alfalfa; the increase in the first cutting of alfalfa hay following this inoculation was 336 per cent.

"Inoculation for cowpeas and lespedeza was apparently unnecessary in the soils used in these experiments. In or near all of these soils these 2 crops have been growing for years. Hence we may infer that these soils have been previously inoculated by germ-laden dust or by some other natural agency.

"In a soil which for many years had borne no leguminous plants tubercles developed without intentional inoculation on hairy vetch, Canada field peas, crimson clover, and lupines, as well as on cowpeas and lespedeza. This soil was more nearly independent of inoculation than any other soil tested, and yet even on this soil the increase in the weight of inoculated plants over plants not inoculated was 38 per cent with hairy vetch, 58 per cent with Canada field peas, and 79 per cent with crimson clover.

"Many soils are naturally inoculated as regards the most commonly grown leguminous plants, and hence are not benefited by artificial inoculation."

The color of rye grains, N. WESTERMEIER (*Abs. in Jahresber. Agr. Chem., 19 (1896), p. 338*).—The grains of 27 heads of Heine improved Zeeländer rye were separated according to their color into the following groups: 5.67 gm. or 6.4 per cent of grayish green grains; 10.068 gm. or 11.3 per cent intermediate between grayish green and light brown grains; 58.68 gm. or 66.4 per cent of light brown grains; and 14.085 gm. or 15.9 per cent of dark brown grains.

The weight per thousand grains is given as follows: The grayish green, 47.25 gm.; intermediate, 45.97 gm.; light brown, 41.07 gm.; dark brown, 38.69 gm. The grayish-green grains were the least in number, but they were heavier than any of the others, while the dark brown kernels were the lightest. The grayish-green color is said not to be caused by the content of the gluten cells, but by the chlorophyll which occurs in the outer cell layers of the seed coat.

These different colored grains were planted in 1894, the plants being allowed to stand about 9 by 9 in. The plants resulting from the grayish-green kernels produced the heaviest grains and the heaviest and largest number of heads, while the grains and heads of the plants from the dark brown seed were smallest in number and least developed. The influence of the color of the seed on the percentage by weight of grains of different color in the resulting crop is shown in the following table:

Transmission of color of rye grains.

Color of seed.	In the resulting crop—			
	Grayish green.	Intermediate.	Light brown.	Dark brown.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Grayish green	76	8	13	3
Intermediate	46	2	49	3
Light brown	25	3	66	6
Dark brown	17	6	68	9

It is concluded that the chlorophyll content of the seed coat was transmitted to the progeny, and that the dark brown grains, the color of which is believed to have been caused by unfavorable influences during the ripening period, were incapable of transmitting their color.

The soy bean as a forage crop, T. A. WILLIAMS (*U. S. Dept. Agr., Farmers' Bul. 58, pp. 3-19, figs. 5*).—This bulletin treats of the general characteristics and origin of the soy bean, the value of the different varieties, the conditions necessary for its growth, the methods of culture and harvesting, and the yield. The composition of the soy bean at different stages of growth, the chemical composition of the various kinds of forage made from the plant, a comparison of the amounts of food constituents produced by an acre of the soy bean and an acre of fodder corn, the percentage of digestibility of the various nutrients, and a comparison of green forage per acre and fertilizer ingredients in the crop and roots of soy beans, cowpeas, and clover are given in tables. Discussions of the chemical composition, digestibility, and value and uses of the soy bean for silage, hay, pasture, and soil renewing are given. The author gives the following summary:

"The soy bean thrives best in soils of medium texture well supplied with lime, potash, and phosphoric acid. It endures drought well, is not easily injured by excess of moisture, and may be grown about as far north as corn.

"The early varieties are best for seed crops, and the medium or late varieties for hay, forage, and silage. Seed may be planted at any time during the spring and early summer, but preferably as soon as the ground becomes well warmed up. Drill one-half to three-fourths of a bushel to the acre; broadcast three-fourths to 1 bushel.

"Little cultivation is needed when growing for forage; when for seed keep weeds down until plants shade the soil. The soy bean may be used for soiling, pasturage, hay, and silage, or the beans may be harvested and fed as grain.

"The forage is very rich in fat and muscle-making materials and should be fed with fodder corn, sorghum, or some other feeding stuffs rich in fat-forming nutrients. The seed can be fed to the best advantage when ground into meal and is almost without equal as a concentrated food.

"Cut for hay when the plants are in late bloom or early fruit; for silage the crop can be cut later, but it is better to cut before the pods begin to ripen; for green forage cutting may begin earlier and continue rather later than for either hay or silage; the crop may be cut for seed after the pods become about half ripe.

"The soy bean is excellent for green manuring and for short rotations with cereal crops. It should be well limed when plowed under as a green manure."

Mineral constituents of the sugar cane crop, P. BONÂME (*Rap. An. Sta. Agron. [Mauritius], 1896, pp. 63-73*).—A very thorough study of the chemical composition, especially the mineral constituents, of sugar cane is reported, the principal results of which are given in the following table:

Composition of sugar cane at different stages of growth.

	May 6.		June 6.		July 6.		August 6.		September 6.		October 6.	
	Canes.	Leaves.	Canes.	Leaves.	Canes.	Leaves.	Canes.	Leaves.	Canes.	Leaves.	Canes.	Leaves.
	Pr. ct.	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*
Water	78.100	81.540	76.600	77.000	74.670	77.270	75.130	74.170	74.400	77.060	76.700	80.000
Silica	0.176	0.711	0.320	1.310	0.208	1.037	0.227	1.285	0.212	1.159	0.238	1.088
Chlorin	.016	.067	.021	.096	.005	.060	.003	.055	.002	.062	.003	.082
Sulphuric acid	.029	.077	.061	.122	.031	.088	.041	.148	.036	.142	.040	.084
Phosphoric acid	.023	.060	.036	.070	.020	.064	.019	.072	.018	.053	.025	.050
Lime	.025	.089	.048	.121	.029	.101	.034	.155	.033	.149	.037	.112
Magnesia	.034	.069	.060	.096	.043	.107	.039	.173	.036	.112	.031	.075
Potash	.150	.450	.188	.512	.068	.335	.052	.298	.046	.301	.090	.388
Soda	.006	.008	.004	.017	.002	.009	.001	.037	.002	.012	.003	.009
Oxid of iron	.010	.028	.012	.033	.005	.014	.007	.009	.004	.015	.006	.014
Total	.469	1.559	.750	2.378	.406	1.815	.423	2.232	.389	2.004	.473	1.902
Nitrogen	.110	.158	.131	.224	.071	.183	.074	.202	.106	.252	.100	.209
Proportion of cane and leaves	66.100	33.900	70.500	29.500	66.500	33.500	69.700	30.300	75.100	24.900	79.600	20.400
Sucrose in cane	9.560	......	9.940	......	12.260	......	13.140	......	13.700	......	11.500	......
Glucose in cane	1.310	......	1.200	......	.980	......	.650	......	.450	......	.450	......

Field experiments with fertilizers, C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1896, pp. 205–215*).—These consist of special nitrogen experiments with corn, legumes, and grasses, and a soil test with fertilizers on oats. Yellow and white flint corn and cowpeas are to be grown under the same conditions for a number of years in succession, and this report is for the second year of the experiment. Each crop occupied 10 plats, 8 of which received 320 lbs. of dissolved bone black and 160 lbs. of muriate of potash per acre. Some of these plats received in addition 25, 50, and 75 lbs. per acre of nitrogen in the form of nitrate of soda or sulphate of ammonia. The unmanured plats were used as check plats. All results are tabulated. Previous work in this line was reported in the Annual Report of the station for 1895 (E. S. R., 8, 398).

The yield of corn was less on the dissolved bone black and muriate of potash plats than on the nitrogen plats. In most cases the yields of the nitrogen plats were less where only 25 lbs. of nitrogen per acre was used than where 50 or 75 lbs. was applied, but the increase in yield was not proportional to the increase in nitrogen. The percentage of protein in the total crop was higher where nitrogen was used and increased with the quantity of nitrogen applied.

A larger yield of cowpeas was obtained from the plats dressed with bone black and muriate of potash than from the check plats. Nitrate of soda increased the yield over all the plats. The effect of nitrogen was not very marked, the largest yield being obtained where the smallest amount of nitrogen was added. "There seems to be very little relationship between the percentages of protein in the crop and the quantity of nitrogen used in the fertilizer."

The soil-test experiment is the seventh in a series, the same kinds of fertilizers being used on the same plats year after year. The crops were rotated. Where only 1 ingredient was used nitrogen had the greatest influence on the yield, and where 2 ingredients were combined nitrogen and phosphoric acid gave the best results. The plat with all 3 ingredients gave very little increase over the plat receiving nitrogen and phosphoric acid.

Field experiments with fertilizers, C. E. THORNE, J. F. HICKMAN, and W. J. GREEN (*Ohio Sta. Bul. 80, pp. 143–175, fig. 1*).—The general plan of this experiment has been outlined in a former bulletin (E. S. R., 8, p. 576). The work comprises fertilizer tests with crops grown continuously on the same land and in 5 and 3 year rotations. This bulletin reports in tabular form the results obtained in 1896 and the average results for the 3 years the experiments have been in progress. The results are discussed and conclusions drawn.

The authors found that on the clay soils phosphoric acid appeared to be the most effective fertilizer constituent for cereals and clover in rotation, but that its full effect was attained only when applied with nitrogen and potash. The quantities of nitrogen and potash in the fertilizers used are considered greater than necessary for the full utilization of the phosphoric acid, and the indications were that nitrogen and potash applied in about equal quantities with phosphoric acid largely in excess makes the most effective fertilizer in proportion to the cost.

"In the continuous culture of cereals nitrogen appears to be the most important constituent of the fertilizer, but as in rotative cropping it is the complete fertilizer containing phosphoric acid and potash as well as nitrogen which produces the maximum effect. . . .

"The cost of the fertilizer has been greater than any increase produced from it in crops grown continuously on the same land in these experiments. When the cereals have been grown in rotation with clover the cost of the fertilizer has been recovered with a margin to spare, provided nitrogen and potash were used in small proportion relatively to phosphoric acid, and when potatoes formed one crop in the 3-year rotation with wheat and clover, it has been comparatively easy to secure a profit on the fertilizer.

"In rotative cropping, ordinary barnyard manure has produced an increase to the value of $1 to $1.50 for each ton of manure, this increase being found chiefly in the hay crops, whereas the increase from chemical or slaughterhouse fertilizers is shown chiefly in the grain crops. . . .

"The nitrogen, phosphoric acid, and potash in wheat bran and linseed meal seem to be nearly or quite as effective in producing increase of crop as the same constituents in the ordinary mixed fertilizers of commerce. . . . By proper care of the manure, a large portion—probably the larger portion—of the cost of these valuable feeding stuffs may be recovered in the manure."

Tests of fertilizers on wheat, D. O. NOURSE (*Virginia Sta. Bul. 69, pp. 109–111*).—This is in continuation of work reported in Bulletin 47 of the station (E. S. R., 8, p. 221). Suggestions relative to making plat experiments are given, and the results are tabulated.

Nitrogen, phosphoric acid, and potash were applied singly and in combinations of 2 and 3. The standard application consisted of 142.5

lbs. dissolved bone black, 50 lbs. muriate of potash, and 240 lbs. nitrate of soda per acre, "representing the full amount of phosphoric acid and one-half the amount each of potash and nitrogen found in a crop of 25 bu. of wheat per acre."

The yields obtained from the plats to which the phosphoric acid and potash and phosphoric acid and nitrogen had been applied were nearly 3 times as great as those from the unfertilized plats. When applied in combinations of 3 the proportions of the different elements were varied. The standard amount of each element was decreased and increased by one half and applied with the standard amounts of the other 2. The increase and decrease of potash and nitrogen did not seem to have a definite influence on the yield, but in the case of phosphoric acid the yield varied in proportion to the amount supplied. Increasing the standard application of phosphoric acid by one-half did not increase the yield to a sufficient extent to warrant the practice. "On the whole the indications are that fertilizers for this section should contain but a small amount of nitrogen and potash but a large amount of phosphoric acid."

Report of the agriculturist, D. D. JOHNSON (*West Virginia Sta. Rpt. 1891, pp. 48–58*).—Presents the needs of the station and gives an outline of experiments in progress.

Cowpeas, J. G. SMITH (*U. S. Dept. Agr., Division of Agrostology Circ. 5, pp. 10*).—A reprint of an article from the Yearbook of this Department for 1896 (E. S. R., 9, p. 551).

Notes on flax culture, H. W. ANDREWS (*Agr. Students' Gaz., 8 (1897), No. 5, pp. 129–135*).—Notes on the culture of flax for fiber in Ireland with descriptions of the processes of rippling, retting, drying, and scutching.

The composition of the seed of fodder beets, A. DEVARDA (*Landw. Vers., Stat., 49 (1897), No. 3, pp. 239, 240*).—The composition with reference to food constituents of 7 varieties and the average composition of the ash.

The sugar-beet industry (*Nebraska State Bd. Agr. Rpt. 1896, pp. 217–299*).—This is in part a reprint of the papers and addresses presented at the meetings of the Nebraska Beet Sugar Conventions held in 1896. A wide range of subjects was discussed, including the history and condition of the industry in this country and abroad, the world's sugar supply and demand, experiences in sugar-beet culture by practical men, and the growth and probabilities of the industry in Nebraska.

A report by the State sugar inspector on the campaigns of 1891–'95 shows the estimated amount paid out by the factories for labor, beets, and materials used in the process of manufacture, and the total receipts for sugars. A partial list is given of farmers who raised sugar beets, with the amounts they received for the crop, the acreage, and the tonnage per acre.

An address by an architect and designer of beet-sugar factories treats extensively of the erection and operation of beet-sugar factories in Nebraska.

The methods of producing sugar-beet seed are outlined in an address on the production of beet seed in the United States.

On the effect of humus on the nitrogen content of oats, H. W. WILEY (*Landw. Vers. Stat., 49 (1897), No. 3, pp. 193–202*).—This article has previously been abstracted from another source (E. S. R., 9, p. 444).

Methods of curing tobacco, M. WHITNEY (*U. S. Dept. Agr., Farmers' Bul. 60, pp. 15*).—This bulletin describes the methods of curing Northern Cigar, White Burley, Bright Yellow, Export, and Perique tobacco, and the methods of curing tobacco in Florida. A classification and description of types of tobacco is given. The author makes some suggestions regarding the marketing of tobacco.

Variations in the quality of wheat grains, A. SCHISCHKIN (*Deut. Landw. Presse, 24 (1897), No. 100, p. 909*).—The specific gravity, absolute weight, and nitrogen content were determined of 19 samples of 1 variety of wheat grown under systems of rotation without application of fertilizers. The samples represented 19 different seasons. It is shown that the absolute weight of wheat grains varies considerably in different seasons, but that the specific gravity remains comparatively constant. The nitrogen content varied from 2.205 per cent in 1882 to 3.173 per cent in 1891. No connection is believed to exist between the nitrogen content and the absolute weight. The samples from the smaller yields were characterized by a high nitrogen content.

Experiments on the effect of magnesia on wheat, N. PASSERINI (*Bol. Scuola Agr., 3 (1895), pp. 140–142; abs. in Jour. Chem. Soc. [London], 72 (1897), No. 142, II, p. 587*).—Applications of magnesium carbonate at rates of 200 to 500 kg. per hectare reduced both yield and quality.

The prevention of winterkilling of grains (*Deut. Landw. Presse, 24 (1897), No. 96, p. 871*).—The results of experiments lead to the conclusion that grains are better protected during the winter on lands with a rough surface than on lands which have been smoothed down.

HORTICULTURE.

Asparagus culture, R. B. HANDY (*U. S. Dept. Agr., Farmers' Bul. 61, pp. 39, figs. 17*).—This is a popular bulletin on asparagus culture, including discussions of history, botany and varieties, production of plants from seed, selection of plants, selection and preparation of soils, planting and cultivation, manuring beds, harvesting and marketing, canning and drying, and fungus diseases. The bulletin also contains an article on insect enemies of asparagus by F. H. Chittenden.

In regard to selection of seed, the author recommends that during the spring cutting the plants producing the largest and earliest spears be marked, care being used to have a pollen-bearing plant near the seed-bearing ones to insure pollination. The next spring, one or two of the largest stocks of each of the marked hills should be left, all other stalks being cut for market. These early stalks will then bloom before the later appearing ones, and thus prevent pollination from inferior plants. Of the seed produced by these plants only the largest, plumpest, and best should be used.

In regard to manuring the beds, the author emphasizes the importance of applying fertilizers in the spring and summer when the plant is growing rapidly and storing up reserve material for the next spring's crop of spears, rather than applying it in the autumn or winter when the plant is dormant.

Department of horticulture and forestry, C. B. WALDRON (*North Dakota Sta. Rpt. 1896, p. 19*).—A brief report of the work of the year. Experiments with cabbage, cauliflower, and onions gave no results on account of the ravages of cutworms. The experiments with celery lead to the following conclusions:

"(1) The period of transplanting can not safely be delayed after June 1.

"(2) Banking the celery when the soil is excessively dry, especially during warm weather, causes the celery to rot at the heart. To avoid both rust and rot, heavy banking should not begin until cold weather in September.

"(3) The best distance apart for the rows is 4 ft. Under this system alternate rows should be banked and bleached, and then removed when the remaining rows are similarly handled.

"(4) Celery for winter use, planted in boxes, cellars, or pits, should have the roots pruned back to 2 in. in length and the bunches should also receive considerable top pruning, but the outer stalks should not be stripped off.

"(5) White Plume is the best variety so far for general culture."

Grafting the apple, S. C. MASON and I. JONES (*Kansas Sta. Bul. 65, pp. 18, pls. 7*).—In the introduction to the bulletin the authors consider the objections usually urged against grafting. The objection based on the variable character of seedling stocks is considered valid unless the grafts are planted so that roots are thrown out above the point of union of stock and scion, thus placing the trees on their own roots.

Experiments were begun at the station in 1889 to test the merits of various lengths of scions and different portions of the roots for grafting. No. 1 apple roots from French Crab seedlings were used. In the first experiment, uniform 6-in. Ben Davis scions were grafted on different parts of roots. The tops of the seedlings were cut off below the crown and the roots cut into 3 pieces. One hundred grafts were made with the upper part of the roots, 100 with the middle part, and 100 with the lower part, or tips of the roots. About 80 per cent of the grafts made with the upper and middle parts of the roots grew and at 1 and 2 years old there was little difference between the trees grown from them. Of the grafts made with the root tips only 60 per cent grew. The first season the trees of this lot averaged one-third less in height than the other lots and were more slender and weak. The difference was less marked the second year.

The same year that the above experiment was begun 100 Ben Davis scions 2 ft. long were grafted on the upper parts of roots cut below the crown. At 2 years old these trees were about one-half larger and stronger than the trees from 6-in. scions on similar stocks. Many of the tops were so heavy as to necessitate summer pruning.

In 1893 more extensive experiments were begun to test the merits of various lengths of scions and stocks and the merits of grafting above and below the crown. The stocks used were all No. 1 seedlings, regraded to get a more uniform lot. The scions were also as uniform as possible. Winesap, Missouri Pippin, Ben Davis, and Maiden Blush were used in each series of grafts made. Three lengths of scions, 6, 12, and 24 in., were used. With each kind of scion 4 lengths of stocks were used, namely, piece roots $1\frac{1}{4}$, $2\frac{1}{2}$, and 5 in. long, and whole roots. For all piece-root grafts the upper parts of roots were used. In all cases except where $1\frac{1}{4}$ in. stocks were used one-half of the grafts were made 1-in. above the crown and the other half below the crown. Besides the above a number of grafts were made on $2\frac{1}{2}$-in. piece roots of small size. In all 9,200 grafts were made. The grafts were stored during the winter under uniform conditions, and in the spring set in nursery rows. The place of union of stock and scion in all cases was about 3 in. below the surface of the soil.

The percentage of loss was great, owing to the very unfavorable spring and to the grafts having been stored in a cellar which was too warm. The loss with the whole root grafts was least and increased as the length of root diminished. At the end of the first year 81.6 per cent of the whole root grafts were living, 48.5 per cent of the 5 in., 17.2 per cent of the $2\frac{1}{2}$ in., 11 per cent of the small $2\frac{1}{2}$ in., and 6 per cent of the $1\frac{1}{4}$ in. piece root grafts. At the end of the third season measurements were made of the height of the trees and the diameter of the trunk 1 ft. above the ground. The data obtained are given in tabular form. The greatest growth was made in trees grafted on the longest stocks and the growth declined gradually though slightly with the shorter stocks, being about 11 per cent greater with the whole root than with the $1\frac{1}{4}$ in. piece root grafts. The trees also showed a tendency to make the best growth from the longest scions, the growth being 11 per cent greater with the 24 in. scions than with the 6 in. ones. There was no constant difference in growth between the trees grafted above the crown and those grafted below it.

In 1894 the above experiment was repeated in part with Winesap, Ben Davis, and Missouri Pippin apples, using 6, 12, and 24 in. scions on whole root, and 5 in. piece root stocks grafted both above and below the crown. Tables are given showing the data obtained from the measurements of the diameter and height of trees grown from the various kinds of grafts. After 2 years' growth there was no constant difference between trees grafted above the crown and those grafted below, either as regards height or diameter. The length of the stocks and scions had a marked influence on the growth, the difference in favor of the long stocks and long scions being practically constant in all cases. The height of 2-year-old trees grafted on whole roots averaged 4.81 ft., and on 5 in. stocks 3.96 ft. The diameter of the former was 0.48 in. and of the latter 0.368 in. The average height of trees from 24 in. scions was 4.79 ft.; from 12 in., 4.37 ft.; and from 6 in. scions, 3.98 ft.; and the diameters were 0.52 in., 0.411 in., and 0.388 in. respectively. From measurements made after 3 years' growth, the authors conclude that the differences due to length of either stock or scion are greater in the first and second years than in the third, the average diameters of 3 trees from 24, 12, and 6 in. scions being 0.788, 0.741, and 0.737 in. respectively.

In 1895 grafts were made with 12 and 6 in. scions on whole roots, 5 in. roots, and $2\frac{1}{2}$ in. roots grafted above and below the crown. In addition a stock grafted above the crown and with roots cut 8 in. long was tested. A table shows the measurements of trees at 2 years old. No constant differences were obtained in favor of either length or style of stock or of grafting either above or below the crown. The trees from 12 in. scions were invariably greater in height and diameter than those from 6 in. scions.

In summing up the experiments the authors say that the difference of growth in favor of the longer scions and stocks is probably not sufficient to compensate for the extra labor and expense made necessary by their use.

Besides the measurements made in the experiments the roots were studied and many photographs made. A number of the photographs are shown in the bulletin and the root characters discussed. From an examination of the roots the authors conclude:

"First, that the main root growth from all lengths of stock is made, in the first year, at or just below the union of the stock and scion; second, that the growth at this point becomes more pronounced in the second and third year's growth of the tree; third, that growth from the lower portion of the stock is very slight during the first year and becomes of less importance during the second and third; fourth, that this lower growth is greatest on the shorter piece roots and least on the whole root; and fifth, that where the graft is buried deeply a new system of side roots will take the lead at about the usual depth below the surface of the soil, to the more or less complete dwarfing of the lower and earlier root systems."

The authors believe that the main roots of apple trees are formed naturally near the surface of the soil, and that the use of long taprooted stocks therefore is of no advantage except to induce a slightly greater growth the first year or two.

An experiment by F. Wellhouse, president of the Kansas Horticultural Society, showing the effect of different stocks on the growth and longevity of apple trees is given. In 1876 600 grafts each of Winesap, Ben Davis, and Missouri Pippin apples were made on whole root stocks; 600 grafts of each variety were made on 4 in. roots grafted 2 in. above the crown, and 600 on similar roots grafted 4 in. above the crown; and an equal number of grafts of each variety were made on 4 in., 3 in., 2 in., and 1 in. roots, all cut below the crown. In all cases 6 in. scions were used. The grafts were set in the nursery, those grafted above the crown being set so that the union was above the ground. After 2 years' growth all were taken up and sorted into 2 grades. From the 1,800 grafts made by each method the following percentages of first grade trees were obtained: Whole root stocks, 85.2: 4 in. piece roots, 85.5; 3 in. piece roots, 84.5; 2 in. piece roots, 85.6; 1 in. piece roots, 56.8; 4 in. roots with grafts 4 in. above the crown, 68.6; and 4 in. roots with grafts 2 in. above the crown, 73.6. The roots of the trees grafted above the crown were more irregular than the others. None of the whole root and 4 in. piece root grafts and but few of the 3 in. piece root grafts rooted above the union. Nearly all of the 2 in. and all of the 1 in. piece root grafts rooted above the union. The 2 in. piece root lot was the most satisfactory of all. With all kinds of grafts the original roots of the stocks made little or no growth after being set in the nursery, new roots having been formed in all cases.

About 400 trees of each of the 3 varieties grown from whole root stocks were set in an orchard together with trees from 2 in. piece root stocks. During 19 years no difference in growth, vigor, or fruitfulness has been observed between them, except that for the first 6 or 8 years the whole root trees threw up from their roots more water sprouts than the piece root trees.

Prune growing in Oregon, U. P. HEDRICK (*Oregon Sta. Bul. 45, pp. 5–75, figs. 18, pls. 4*).—This is a popular discussion of prune growing, including climate and soils, planting, cultivating, pruning, thinning fruit, cross-pollination, varieties, stocks, picking fruit, curing and evaporating it, evaporators, diseases of prunes, etc.

About 26,000 acres are devoted to prune growing in the State, mainly in the Willamette and Umpqua River valleys. Rich, loamy river bottom and valley soils are recommended as best for prune growing. Shallow soils are to be avoided. Myrobalan plum is most used as a stock for grafting prunes, though Marianna is considered a better stock by the author, because it does not dwarf the tree, its seedlings are not so variable, its roots do not sucker so much, it unites with all varieties of prunes, and cuttings from it root much easier than from the Myrobalan. Thinning fruit is strongly recommended. Descriptions are given of most varieties of prunes that have been tried in the State and of many others that have succeeded in California.

Descriptive notes on the shot hole fungus (*Cylindrosporium padi*), brown rot (*Monilia fructigena*), black knot (*Plowrightia morbosa*), prune rust (*Puccinia pruni*), curl leaf of the Italian prune, and gummosis are given, together with remedies for each. Studies at the station have led to the belief that "gummosis is the result of a degeneration of the tissues of the tree, brought about by injuries, principally by frost, and secondly sun scald." The author also thinks that overcultivation and lack of drainage may cause the trouble. He recommends wrapping the trees with heavy paper, cloth, or straw to protect them from frost and sunscald, and favors any treatment that will insure thorough maturity of the wood. The author considers the curl leaf of the Italian prune to be closely associated with injury from hot waves to the somewhat delicate epidermal leaf cells of the Italian prune.

The composition of Oregon prunes, G. W. SHAW (*Oregon Sta. Bul. 45, pp. 91–98*).—A preliminary investigation of the composition of Oregon prunes is reported. The author briefly discusses the importance of such studies. Tables showing the composition of samples of both fresh and dried prunes of different varieties are given, together with explanatory notes on the analyses.

The average weight of the Petite prunes examined was 24.9 gm., of the Italian prunes, 32.4 gm.; the ratio of pits to fruit in the Petite averaged 1:14, in the Italians 1:19. A comparison of ripe and unripe fruit was made, the ripe fruit being such as fell from the trees after a very gentle shake, and the unripe such a fell only after a very vigorous shake. The comparison showed that from 100 lbs. of fresh ripe fruit there could be obtained 40 lbs. of dried fruit, and from an equal quantity of unripe fruit only 35 lbs. The edible portion of the product of the ripe fruit contained 25.6 per cent sugar, and that of the unripe fruit 19.18 per cent. The average sugar content of the juice of the Oregon prune was found to be 17.52 per cent, or about 2.5 per cent less than the average for California prunes. On the other hand, the Oregon prunes contained a greater percentage of albuminoids than California prunes, the percentage in the edible portion being 1.32 in the former as against 0.837 in the latter. The composition of the ash of prunes is to be treated in a future publication.

Vegetable forcing, H. G. WINKLER (*Columbus, Ohio: The Winkler Book Concern, 1896, pp. 157*).—The book is divided into 3 parts. The first part deals with the management of greenhouse crops, including lettuce, tomatoes, cucumbers, radishes, rhubarb, asparagus, eggplants, celery, peas, and beans. It discusses the methods of culture employed in forcing the various vegetables and gives the varieties of each that are best suited for forcing. The second part of the book has to do with the construction of forcing houses and methods of heating and watering. The third part considers the construction and use of hotbeds and cold frames.

A very considerable part of this work is taken from other books and from experiment station publications. In a few cases no credit is given for the matter borrowed, though the original phraseology has been but slightly modified.

The kitchen garden: A treatise on the culture of garden vegetables in the open air and in hotbeds, E. GRIFFON (*Le jardin potager. Traité de la culture des plantes maraîchères à l'air libre et sur couche. Tournay: E. Griffon, 1897, pp. 190, figs. 100*).

The kitchen garden, L. J. TROUCET (*Le jardin potager. Paris: Larousse, 1897, 2. ed., pp. 181, figs. 190*).

The manuring of garden plants by means of artificial fertilizers: Practical directions for the use of artificial manures, R. OTTO (*Die Düngung der Gartengewächse mittelst künstlicher Düngemittel. Praktische Anleitung zur rationellen Verwendung künstlicher Düngemittel. Proskau: A. Kalesse, 1897, pp. VI, 62, figs. 7*).

Mushrooms and their use, C. H. PECK (*Cambridge, Mass.: Cambridge Botanical Supply Co., 1897, pp. 80, figs. 32*).—A reprint of a series of articles in *Cult. and Country Gent., 1894, May–Sept.*

Composition of haricots, lentils, and peas, BALLAND (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 2, pp. 119–121*).—A table is given showing the maximum and minimum composition of haricots, lentils, and peas, with notes on variations in composition of different varieties. The seeds undergo no change in chemical composition when kept for a long time, but their power of absorbing water diminishes with their age.

Analyses of sweet potatoes, W. B. HARDIN (*South Carolina Sta. Rpt. 1896, p. 35*).—Analyses were made of 7 varieties of sweet potatoes grown at the station, and 3 grown elsewhere in the State. The results of the determinations of carbohydrates and water were as follows: Starch, maximum 28 per cent, minimum 23.74 per cent; glucose, maximum 0.78, minimum 0.47; sucrose, maximum 2.8, minimum 1.81; water, maximum 67.55, minimum 63.04.

Report of the horticulturist, J. F. C. DU PRE (*South Carolina Sta. Rpt. 1896, pp. 39–44*).—A statement of the work of the year, a list of donations to the department, the amount of rainfall by months, and brief notes on various fruits.

Russian horticulture, F. W. TAYLOR (*Nebraska State Hort. Soc. Rpt. 1897, pp. 45–50*).—A brief sketch of Russian pomology from observations made in the summer of 1896. The value of various Russian fruits for introduction into America is considered.

Revised fruit list (*Nebraska State Hort. Soc. Rpt. 1897, pp. 230–232*).—Lists of varieties of apples, peaches, plums, cherries, raspberries, and grapes recommended by the Nebraska State Horticultural Society for general planting and for trial in the various fruit districts of the State.

Book on horticulture: The raising of large and small fruits, the diseases of the same, and the making and care of lawns, R. T. WOODWARD (*Boston: R. T. Woodward, 1897, pp. 74*).

Is there permanent prosperity for the Oregon prune industry? H. B. MILLER (*Oregon Sta. Bul. 45, pp. 1–4*).—A discussion of the law of value as applied to the Oregon prune industry.

Report upon fruit trees, plants, etc., W. W. BROWN (*West Virginia Sta. Rpt. 1891, pp. 64–66*).—Brief notes on several varieties of plums, prunes, persimmons, etc., set out for experimental purposes in the spring of 1889.

Fruits of Ontario, L. WOOLVERTON (*Ontario Fruit Expt. Stas. Rpt. 1896, pp. 1–40, figs. 67*).—Illustrations, descriptions, and notes on the history and adaptability to Ontario of a number of varieties of apples, pears, peaches, cherries, strawberries, and grapes. The illustrations are all original.

Records for 1896 (*Ontario Fruit Expt. Stas. Rpt. 1896, pp. 87–115*).—Data obtained from variety tests of several kinds of fruit at a number of substations in Ontario.

Soils, earths, and composts employed in horticulture, G. TRUFFAUT (*Sols, terres, et composts utilisés par l'horticulture. Paris: O. Doin, 1896, pp. 308, figs. 3*).—The subject is treated in 2 parts. The first part is a general discussion of soils, their formation and relation to plant growth. It includes chapters on the relation of plants to the soil, general considerations in regard to soils, the physical properties of soils and their modification, and the chemical composition of soils, or the soil as a source of plant food. The second part of the book considers the different types of soils, enumerates the horticultural plants for which each type is suited, indicates the fertilizers to be used with each, discusses the preparation and use of artificial soils and composts employed in horticulture, and gives the chemical composition of a number of fruits, vegetables, and ornamental plants. Some of the principles discussed in the work are illustrated by a description of the culture of azaleas.

The utilization of fruits in the household and in industrial pursuits, B. L. KÜHN (*Die rationelle Obstverwethung in Haushalte und gewerblichem Betriebe. Berlin: F. Cynamon, 1897, pp. 209, figs. 60*).—The book treats of the selection of varieties of fruits; the picking, sorting, packing, storing, and shipping of fruits; the manufacturing of dried fruits, jellies, ciders, marmalades, preserves, etc. Many illustrations are given of the implements and apparatus used.

Fruit evaporation, H. E. DOSCH (*British Columbia Growers' and Hort. Soc. Rpt. 1895–'97, pp. 99–104*).—Notes on the construction of evaporators and on the evaporation of prunes, pears, and apples.

A treatise of fruit-tree culture, P. PASSY (*Traité d'arboriculture fruitière. Paris: J. B. Baillière et fils, 1897, pp. 600, figs. 300*).—The work is published in 3 volumes. The first volume treats in a general way of the establishment of a nursery and fruit garden, planting and arrangement of trees, grafting, pruning, etc. The other volumes have to do with particular fruits, considering in the case of each fruit the special methods of pruning, the principal varieties, and the insect and fungous enemies. The second volume deals with the pear, apple, quince, medlar, etc. The third volume includes the peach, apricot, plum, cherry, almond, grape, gooseberry, currant, fig, walnut, chestnut, hazlenut, etc.

Peach culture in the open air (*Garden, 53 (1898), No. 1363, pp. 7, 8, fig. 1*).—The article discusses soil, planting, training, pruning, thinning fruit, varieties, etc.

Peaches and nectarines under glass, W. TURNER (*Amer. Gard., 18 (1897), Nos. 154, p. 822; 155, p. 838, fig. 1*).—Notes on culture.

Japanese persimmons, R. L. WATTS (*South. Florist and Gard., 5 (1898), No. 1, pp. 18, 19, figs. 3*).

Strawberries in 1896, E. B. STEVENSON (*Ontario Fruit Expt. Stas. Rpt. 1896, pp. 75–86, figs. 18*).—Notes with descriptions of a large number of varieties of strawberries.

Propagation and pruning of currants (*Can. Hort., 11 (1898), No. 1, pp. 31–33, figs. 3*).

Pecan culture in Louisiana, S. H. JAMES (*Rural New Yorker, 57 (1898), No. 2502, p. 19, fig. 1*).

Manual of floriculture, F. RODA (*Manuale di floricoltura. Paris, 1897, 2. ed., pp. 264, figs. 87; revised and enlarged by G. Roda*).

The feeding of plants, G. L. PAUL (*Gard. Chron., 3. ser., 22 (1897), No. 565, p. 284, fig. 1*).—A note on the work of G. Truffaut.

Hints on landscape gardening, F. W. CARD (*Nebraska State Hort. Soc. Rpt. 1897, pp. 84–92*).—A brief sketch of the development of landscape gardening, with hints on the ornamentation of grounds.

Practical culture of flowers at home, E. CORBIN (*Nebraska State Hort. Soc. Rpt. 1897, pp. 127–138*).

Achillea (*Garden, 52 (1897), No. 1358, pp. 421, 422, figs. 6*).—Descriptive notes on 24 species of Achillea.

Hardy arums (*Gard. Illus., 19 (1897), No. 974, pp. 515, 516, figs. 5*).—Descriptive notes and illustrations of a number of species of arums.

The dahlia, its history and cultivation, W. CUTHBERTSON, editor (*London: Macmillan & Co., 1897, pp. 81, fig. 1, pls. 9*).—The book contains an article on the history of the dahlia, by R. Dean; the botany of the dahlia, by J. Ballantyne; the propagation of the dahlia and exhibiting the dahlia, by S. Jones; the cultivation of the dahlia, by R. Fife; the future of the dahlia and a catalogue of varieties of the dahlia and selections for special purposes, by W. Cuthbertson.

Hardy British ferns for grouping (*Garden, 52 (1897), No. 1358, pp. 426, 427*).—Notes on a number of species.

The geraniums (Pelargonium zonale and P. inquinans): Description and culture, H. DAUTHENAY (*Les géraniums (Pelargonium zonale et inquinans). Description et culture. Paris: Doin, 1897, pp. VI, 297, figs. 22*).

California irises, C. PURDY (*Garden, 53 (1898), No. 1363, pp. 1, 2*).—Notes on culture and species of irises.

Lilacs and asparagus, F. HARMS (*Flieder und asparagus. Erfurt: Ludwig Möller, 1897, pp. 94, pls. 4, figs 29*).—The book gives descriptions of the principal species of lilacs and ornamental asparagus and directions for their propagation, culture, and forcing.

New orchids of 1897, H. T. CLINKABERRY (*Florists' Exchange, 10 (1898), No. 2, p. 30*).

Bulbous plants and their culture, R. NOTER (*Les plantes bulbeuses et leur culture. Paris: Bornemann, 1897, pp. 36, figs. 21*).

Roses (*Canad. Hort., 11 (1898), No. 1, pp. 3–10, pl. 1, figs. 7*).—Descriptive notes and illustrations of a number of roses.

FORESTRY.

Influence of spring frosts on the growth of oaks and beeches, E. GRIFFON (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 15, pp. 548–550*).—On May 18 a severe frost was experienced in France, the temperature at Fontainebleau registering −8° C. (17.6° F). Great injury was done to vineyards, forests, etc., and the author examined the succeeding shoots of oaks and beeches to ascertain what effect the frost had had on them. The earlier sprouts were killed, but in June others appeared to take their places. These were abundant on the oaks, but less so on the beeches, and their development was inferior to the normal growth. The supporting and protective tissues were poorly developed, and the secondary woody fibers and sclerenchyma of the cortex were entirely undeveloped. In the leaves the pallisade parenchyma was much less differentiated than in the normal leaf.

Practical forestry and its bearing on the improvement of estates, C. E. CURTIS (*London: Lockwood, 1897, pp. 132*).

Life and growth of forest trees, M. BÜSGEN (*Bau und Leben unserer Waldbäume. Jena: Gustav Fischer, 1897, pp. VIII, 230, figs. 100*).

Coniferous forests of Marne and their parasites, A. BELLEVOYE and J. LAURENT (*Bul. Soc. Nat. Sci. Reims, 6 (1897), No. 3, pp. 59–64*).

How can we prolong the supply of white pine? F. ROTH (*Forester, 4 (1898), No. 1, pp. 21, 22*).—Planting, care of seedlings, and protection from fire are recommended.

The history and value of osier willows, K. HETZ (*Korbmacher. Ztg., 3 (1897), pp. 1–4; abs. in Bot. Centbl. Beihefte, 7 (1897), No. 4, p. 295*).

The yew and its distribution in Germany, P. KORSCHELT (*Tharand. Forst. Jahrb., 47 (1897), No. 2, pp. 107–172*).

SEEDS—WEEDS.

Experiments on the germination of seeds from different sized fruits and from cells containing different numbers of seeds, DUKE OF BEDFORD and S. U. PICKERING (*Rpt. Woburn Expt. Fruit Farm, 1897, pp. 160–163*).—The seeds of 100 crab apples averaging 1 oz. each and the same number averaging ½ oz. were selected, and 60 seeds were taken from the cells containing 2 seeds and 10 from cells containing 1 seed each. These were divided into 6 lots and their germination and viability compared.

Comparing the germination of the seeds from the 1 and 2 seeded cells in each lot of fruit, it was found that the difference was inappreciable, being slightly in favor of the 2-seeded cells.

In the comparison of the percentages of germination of seeds from ½ oz. and 1 oz. fruits there was found a decidedly higher percentage in the seeds with smaller fruits. Seedlings from the smaller fruits were in nearly every case more robust than from the larger ones.

These experiments are being repeated with other fruits and with 4 sizes of fruits to determine whether it is merely the relative size of the fruits which affects the germinative power of seeds or whether the results given above are due to the size of the fruits being abnormal as compared with the average sized fruits of the tree.

Investigations of clover and grass seed during 1894, G. GROTENFELT (*Landtbruksstyr Meddel., 1896, No. 18, pp. 74*).—The author reports on the examination of 429 lots of clover and grass seed secured from wholesale and retail dealers and from farmers. The usual data relative to purity, germinative ability, etc., are given.

A report is given on culture experiments made to determine the origin of clover seed, the method by estimation of weed seed not being wholly satisfactory.

Out of 123 samples collected more than two-thirds proved to be either in whole or part of American origin. The author claims that the American clover will not withstand the climate of Finland as well as seed of northern European origin.

The following data compiled from the report gives comparisons of seed of different origin, the seed tested having been secured from wholesale and retail dealers and farmers:

Comparison of European and American red clover seed.

Origin of samples.	Number of samples.	Percentage of germination.			Percentage of viability.			Percentage of weed seed.			Percentage of total impurities.			Weight in gms. of 1,000 seed.		
		Max.	Min.	Aver.	Max.	Min.	Aver.	Max.	Min.	Aver.	Max.	Min.	Aver.	Max.	Min.	Aver.
Wholesale dealers:																
European...	12	94.5	43.5	70.8	95.8	42.7	80.1	6.5	0.2	2.18	9.2	1.0	3.27	1.72	1.45	1.61
American...	2	66.0	31.0	48.5	80.9	51.3	66.1	1.0	.8	.90	1.4	1.3	1.35	1.52	1.52	1.52
Retail dealers:																
European...	27	90.0	8.0	48.7	94.0	8.7	56.2	30.4	.3	4.22	40.1	.9	6.88	1.70	1.40	1.55
American...	64	95.0	15.0	69.5	97.0	19.2	81.4	14.0	.3	2.06	19.0	.9	2.95	1.72	1.40	1.53
Farmers:																
European...	1	.....	.....	41.0	.....	.....	42.4	.....	.....	9.40	.....	.....	18.5	.....	.....	1.55
American...	1	.....	.....	86.0	.....	.....	82.1	.....	.....	4.00	.....	.....	5.6	.....	.....	1.55

—F. W. WOLL.

Weeds, J. FLETCHER (*Canada Cent. Expt. Farm Bul. 28, pp. 44, figs. 16*).—This bulletin gives a general discussion of weed dissemination and methods of eradication and describes the following of the more important weeds: Tower mustard, hare's-ear mustard, tumbling mustard, stink weed (*Thalaspi arvense*), ball mustard, peppergrass, cow cockle, orange hawkweed, viper's bugloss, hound's tongue, Russian thistle, curled dock, and sweet grass (*Hierochloa borealis*). A tabular list of the more prominent Canadian weeds, with their chief characteristics, is given, with methods of propagation and distribution, and suggestions for their eradication.

The effect of soaking beet seeds, M. E. PHIPPCHENKO (*Zemledyelie, 1897, pp. 203–205*).—Soaking beet seed has the effect of shortening the period of growth, since soaked seeds germinate on the 4th, 5th, and 6th day after sowing, while dry seed begins to sprout 2 weeks after sowing. The soaking must be done with care. The author recommends the following: Soak the seed for 12 to 14 days at a temperature from 43 to 48° F., using 35 to 40 lbs. of water to 40 lbs. of seed. All the seeds should be equally dampened, but not wet. To secure this they must be frequently stirred.—P. FIREMAN.

The vitality and the dissemination of seeds, W. W. GLENNY (*Jour. Roy. Agr. Soc. England, 3. ser., 8 (1897), pt. II, pp. 324–334*).—A popular essay on seed vitality, etc.

Concerning the individuality of seed of wheat, barley, and peas, W. FELDMANN (*Beitrage zur Kenntniss der Individualität des Saatkorns bei Weizen, Gerste und Erbsen. Bonn: Friedrich Cohen, 1897, pp. 98, pls. 7*).

Influence of size of beet seed on the yield and quality of the beets, F. LUBANSKI (*Zemledyelie, 1897, pp. 154, 155*).—Experiments are reported which indicate that sowing large seed not only gave a larger yield but a higher sugar content.

The average molecular weight of the soluble matter in germinating seed, L. MAQUENNE (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 16, pp. 576–579*).—Attention is called to the relation which exists between the freezing point of plant juices and the average molecular weights of the substances contained by them. On account of the varying composition of the plant juices during different periods of germination the freezing point also varies.

Kansas weeds, A. S. HITCHCOCK and G. L. CLOTHIER (*Kansas Sta. Bul. 66, pp. 54, pls. 17*).—A catalogue briefly describing 209 species of weeds occurring in Kansas, and giving illustrations of their fruits and seeds.

DISEASES OF PLANTS.

New investigations concerning the specialization, propagation, and origin of the black rust, J. ERIKSSON (*K. Landt. Akad. Handl. Tidskr., 35 (1896), pp. 182–198*).—The following summary indicates the scope of this paper and the status of knowledge of this subject:

The black rust (*Puccinia graminis*) is found in a number of different specialized forms, characterized not only by their summer and winter spore stage on the grasses, but also by their æcidium stage on the barberry and Mahonia. Three different forms are found on cereals: Rye rust (f. sp. *secalis*), common on rye and barley and also appearing on *Triticum repens, T. caninum, Bromus secalinus,* and *Elymus arenarius;* oat rust (f. sp. *avenæ*); oat rust, also appearing on *Dactylis glomerata, Alopecurus pratensis, Avena elatior, Milium effusum,* and other grasses; and wheat rust (f. sp. *tritici*), so far found in nature only on wheat. The rye and oat rusts are sharply confined to their respective species of grasses, and there is little danger of their occurring on other kinds of plants. Under certain conditions the wheat rust differs from the other grain rusts in that it may be propagated both in its summer spore and æcidium stages on closely related grains, at least on rye and barley. The rusts of Aira, Poa, and Agrostis are, so far as now known, wholly harmless to the cereals.

Barberry and Mahonia, being bearers of many of the biologically different æcidium forms, of which one corresponds to the rye and barley rust, another to the oat rust, etc., a rusty barberry (or Mahonia) can only infect grains to which its particular rust belongs, if the barberry (or Mahonia) infected with wheat rust be excepted, which can infect not only wheat, but also other cereals, at least rye and barley. By observing the grasses growing in close proximity to a barberry during the preceding fall and winter, one can judge as to its possible harmfulness and determine whether or not it ought to be removed to protect the grain to be grown near it. The propagation of the black rust from rusty grasses to barberry, as well as from barberry to the grasses, may, at least during dry seasons, be disturbed and even prevented, either by a comparatively narrow intervening strip of tree growth (100 meters), or by very small (10 to 25 meters) open spaces. At a distance of 25 meters from a barberry bush the black rust is found to the same extent in all directions. Some differences may be observed according to the luxuriance of the different plants, the most luxurious plants first becoming rusty.

The hypothesis seems warranted, from the facts known, that the first rust spots do not either directly or indirectly owe their origin to a more or less close proximity to barberry, but to a pathological condition of the grass plant itself, a condition which may have originated from an infection of the young plant in the spring by the winter spores of the rust, or from a disease germ carried in the plant from one year to another.—F. W. WOLL.

Investigations on the specialization of the grain rusts, J. ERIKSSON (*Ztschr. Pflanzenkrank.*, *7* (*1897*), *No. 4*, *pp. 198–202*).—The author continues his observations on the grain rusts. In this paper an account is given of numerous inoculation experiments. In the first series 10 species of grass, representing 6 genera—Lamarkia, Triticum, Hordeum, Secale, Dactylis, and Poa—were inoculated with *Puccinia graminis* from barberry in 1896; and the results of these experiments are reviewed. In every case definite results were secured showing the susceptibility of these species to barberry rust.

In the second series of experiments the inoculation material was taken from the plants previously inoculated from the barberry. It appears that the forms developed on wheat successfully inoculated barley and wheat, but failed on oats and rye. The form grown on *Lamarkia aurea* inoculated that grass and oats. A second form from wheat gave some evidence of successful transfer to barley, but failed on oats, rye, and wheat. The form developed on *Triticum desertorum* failed on wheat and oats, but was successful on the host species, barley, and rye. A third form originated on wheat was very successful in inoculating wheat, but less so when applied to barley, rye, and oats. Spores from *Trisetum distichophyllum* inoculated oats, but failed on wheat and rye. A form from barley infected rye and oats, but produced no rust on wheat or barley. Spores from *Poa cæsia* produced rust abundantly when transferred to that species of grass.

The information relative to the experiments is tabulated and shows the origin of the inoculation material, inoculated plants, number of infections, and time within which rust pustules developed, etc. The time between the inoculation and appearance of rust pustules varied from 10 to 52 days.

Eighth annual report of the station, M. HOLLRUNG (*Jahresber. Vers. Stat. Nematodenvertil. u. Pflanzenschutz, Halle*, *8* (*1896*); *abs. in Centbl. Bakt. u. Par.*, *2. Abt.*, *3* (*1897*), *No. 19–20*, *pp. 535–538*).—The report gives an account of the principal fungus and insect enemies of the sugar beet, potato, chicory, garden plants, cereals, legumes, fruits, and forest trees, and the means adopted for combating them.

It is stated that the potato rot due to *Phytophthora infestans* was especially severe on crops grown on heavy soils, while those grown on light sandy soils were almost exempt from injury. Experiments with Bordeaux mixture on the diseased plants are said not to have given entirely satisfactory results. The presence of organisms in the soil capable of producing scab on potatoes was shown, and soaking the seed tubers in corrosive sublimate solutions for 1½ hours before planting gave good results in preventing scab and also the disease due to *Rhizoctonia solani.*

Notes are given of the occurrence of club root of crucifers, *Penicillium glaucum* on asparagus, mildew of spinach (*Peronospora effusa*), the mildew of cucurbits (*Sphærotheca castagnei*), smuts of cereals, and various diseases of fruit trees.

The more destructive insects of these different plants are enumerated, and a brief account is given of the continued studies on the contents of the stomachs of the rook (*Corvus frugilegus*). Definite conclusions relative to the nature of the rook, whether injurious or beneficial to the farmer, are not yet given, and the investigations are to be continued.

Concerning attacks of black rot, A. PRUNET (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 15, pp. 550–553*).—The author was appointed by the Minister of Agriculture of France to make a study of the black rot of grapes. He has established the periodicity of the disease as shown by the appearance of the well-known spots on the leaves, several attacks occurring during a season. Similar observations are reported by several other investigators.

The severity of the attack is estimated from the abundance of spots on the leaves, and in general the disease seemed to increase rapidly in severity from the first to the third attack, after which it decreased slowly until about the fifth appearance, when it disappeared quite rapidly. The maximum attack on the leaves is about simultaneous with the first invasion of the fruit.

Taking into account the climate, atmospheric conditions, etc., it may be stated that the most disastrous attack on the leaves and axillary organs takes place about flowering time and on the fruit it takes place about the time the grapes are the size of small peas. These two periods usually occur the first in June and the second in July, and are preceded by two invasions of increasing severity. The duration of an invasion for the period of susceptibility to attack varies from 5 to 8 days, dependent on atmospheric conditions, especially the temperature.

In a subsequent publication J. Perraud[1] gives his observations made in 1896 and 1897 in the southeast of France. In general his conclusions relating to the periodicity of development of the black rot agree with the above.

Observations on canker in plum trees, DUKE OF BEDFORD and S. U. PICKERING (*Rpt. Woburn Expt. Fruit Farm, 1897, pp. 164–167*).—Notes are given on an apparently hitherto unrecorded disease of plum trees which was due to *Nectria ditissima.* The disease was first noted in the autumn of 1895, when it was found that in a few cases the cortex of a large portion of the stem and of some of the main branches was entirely dead and rotten. The disease had penetrated to a considerable

[1] Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 19, pp. 728–730.

distance into the wood, but had not affected the periderm, so there was no external indication of its presence except that the affected portions had not kept up in growth with the rest of the tree. The cortex in the diseased part was brownish yellow and moist and possessed an offensive odor. A somewhat similar appearance was presented by the wood. During the spring of 1896 it was found that many more trees had been attacked, and before the end of the summer 14 out of 93 had been killed. So far as known, cutting out the diseased parts has prevented the spread of the fungus, but it is too early to make any definite statements on this point. It is stated that external injuries do not appear necessary for the entrance of the canker spores. In a large number of cases the disease was present when no visible injury could be found, while instances of bark injury with no infection were quite numerous. This observation tends somewhat to discredit the view that canker is necessarily a wound parasite.

Some diseases of orchard and garden fruits, A. D. SELBY (*Ohio Sta. Bul. 79, pp. 97-141, pls. 9, figs. 9*).—Descriptive notes are given of diseases on the gooseberry, raspberry, blackberry, plum, cherry, pear, quince, and apple. Among the diseases of currants and gooseberries the leaf spot and powdery mildew are briefly described, and also the anthracnose of raspberries and blackberries. The red rust of blackberries, leaf spot, a bacterial disease, and crown gall are discussed. The bacterial disease has been determined as due to the same cause as pear blight. The effects are usually visible as brownish dark patches extending around the cane near the surface of the ground. When plantations are seriously affected the canes should be burned. The crown gall of raspberries is said to cause considerable loss. The galls are considered as mostly due to attacks of nematodes. The means for the prevention of this trouble seems to be the destruction of all affected stock, and at the same time care must be taken that other susceptible plants should not be contaminated.

Among the diseases of plum and cherry described are the rot, plum pockets, scab, black knot, shot hole fungus, mildew, and a twig disease accompanied with a gum flow. This disease apparently begins in the region of the buds, which are destroyed and a small dead area formed in the axil of the leaf or at the side of the leaf scar. From this dead area there is usually an exudation of gum, from which fact the disease has been termed gummosis. A similarly diseased condition of the peach is also reported, and both are to be the subject of further study.

The blight, leaf spot, crown gall, and black rot of pears and quinces are described and suggestions given for their prevention. Among the diseases of apples treated are apple scab, sooty fungus, bitter rot, brown spot, sun scald, and crown gall. The causes of these diseases, so far as known, are described and suggestions given for their prevention.

Anthracnose of the black raspberry, W. PADDOCK (*New York State Sta. Bul. 124, pp. 261-274, fig. 1*).—This bulletin gives an account of experiments conducted for 3 years in combating anthracnose of the black raspberry. While the treatment was successful in preventing the disease upon the new canes, the increased yield of fruit did not warrant the expense. The use of healthy plants and short rotation of crops, together with the protection of the new shoots by spraying them in the spring when about 6 in. high with Bordeaux mixture, followed by 2 other applications at intervals of 10 to 14 days, and the removal of all the old canes and badly diseased new ones as soon as the fruiting season is over, is recommended by the author as the best means for combating this disease.

Detailed accounts are given of the experiments conducted at different places, the results of the treatments being tabulated. The canes of different lots were sprayed before the leaf buds opened with copper sulphate solution and with iron sulphate solution, followed by 3 sprayings of Bordeaux mixture. The results seemed to indicate a slight advantage in favor of the use of iron sulphate as a preliminary treatment.

Field experiments to determine the dependence of bacterial gummosis of sugar beets on conditions of weather and soils, P. Sorauer (*Bl. Zuckerrübenbau, 4 (1897), p. 81; abs. in Centbl. Bakt. u. Par.. 2. Abt., 3 (1897), No. 19–20, p. 535*).—The inoculation experiments of the author are briefly mentioned in which the bacterial origin of the disease known as gummosis was established. Other experiments on a more extended scale are here reported, in which it is stated that sugar beets are especially liable to the disease when overmanured, especially when too much nitrate of potash, lime, and sulphate of ammonia are applied to the soil. The application of large amounts of nonnitrogenous fertilizers seemed to be without effect on the crop, so far as producing disease was concerned. Sufficient water during growth is essential, a long, dry, hot spell of weather being very conducive to the disease.

As preventive measures to be adopted, the author recommends attention to the water supply, by irrigation if necessary, and the application of phosphoric acid to the soil.

Notes on the diseases of bulbs of Crocus sativus, E. Roze (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 19, pp. 780–782*).—The author mentions the diseases of *Crocus sativus* which are due to *Rhizoctonia violacea* and *Tyroglyphus feculæ*, and describes another disease of the bulbs which is said to be due to *Saccharomyces croci*, a new species. The cells of this yeast are ordinarily spherical, colorless, from 2 to 6 μ in diameter, and spore bearing. In water they are usually elliptical and carry 2 polar spores.

Experiments in the treatment of fungus diseases of fruit and potatoes, H. H. Lamson (*New Hampshire Sta. Bul. 45, pp. 45–56, figs. 4*).—Popular notes are given on the scab of apple and pear, sooty disease of apples, black rot of plums, and blights and scab of potatoes, together with suggestions for prevention of the same.

Experiments on the repression of apple scab, in which Baldwin apple trees were sprayed with a 1: 10 Bordeaux mixture, showed slightly better results when 2 applications of the fungicide were made than when a single spraying was given immediately after blossoming.

Notes are given on a disease of apples and pears characterized by the appearance of dirty or sooty spots on the skin of the fruit. The spots are roundish in outline, varying in size, and often covering nearly or entirely the surface of the fruit. The principal damage caused is the discoloration of the fruit, the fungus being entirely superficial. This disease was most frequently observed on Greenings and Northern Spies, but occasionally was met with on other varieties. Among pears the Beurre de Anjou and Lawrence were most frequently attacked. Spraying with Bordeaux mixture is said to have reduced the disease by at least 75 per cent.

Notes are given on the black knot of plum, as well as suggestions for its prevention by spraying and cutting away diseased portions of the trees.

Experiments were conducted for the prevention of early blight of potatoes in which the different plats were sprayed 2, 3, and 4 times with 1 : 10 Bordeaux mixture. The best results were secured when 3 applications were made.

Experiments were also made for the repression of potato scab in which the seed was soaked in corrosive-sublimate solution prior to planting. The different plats were fertilized (1) with commercial fertilizer, (2) with stable manure, (3) with plaster, and (4) with wood ashes. The results obtained show the beneficial effect of treating the seed, but do not fully bear out the statements relative to the effect of fertilizers on scab, the plat receiving stable manure showing the least scab of the series, and that receiving plaster the most. Directions are given for the preparation of Bordeaux mixture and its application.

Effect of spraying potatoes and of planting at different dates, Duke of Bedford and S. U. Pickering (*Rpt. Woburn Expt. Fruit Farm, 1897, pp. 150–159*).—Experiments have been conducted to test the effect of Bordeaux mixture on potatoes during the seasons of 1895 and 1896. In neither year was the fungus severe in its attack, and the results secured were correspondingly less than they might have been under other conditions. The spraying in all cases increased the vitality of the potato vines and in 1895 increased the total crop 11.6 per cent, the increase averaging 16.7 per cent for the late varieties and 6.5 for the earlier ones. In 1896 the average gain due to spraying was only 2.8 per cent. In this case among the earlier varieties there was an actual loss, which was attributed to the spraying. In all cases there was a greater percentage of large tubers on the sprayed plats.

The experiment on the effect of planting at different times was in the majority of cases decidedly in favor of early planting, the average increase being 27 per cent of the total crop.

Spraying potatoes on Long Island in the season of 1896, F. C. STEWART (*New York State Sta. Bul. 123, pp. 234–259, pl. 1*).—The author reports upon experiments conducted at Floral Park and East Williston, Long Island, for the prevention of potato diseases. While all the potatoes were unusually free from disease during the season, yet the sprayed plats showed a considerably increased yield over those not receiving any application of fungicide. The total expense of spraying 5 times is estimated at $4 per acre. Estimating the potatoes to be worth 25 cts. per bushel, the increasing yield, with the exception of the plat of Victor Rose potatoes, more than paid for the application.

Fungiroid and "Lion Brand" Bordeaux mixture were tested and found to be much inferior to Bordeaux mixture as ordinarily prepared, and are not to be recommended. The insecticidal value of Bordeaux mixture was apparent, but the author thinks that Paris green should be used in connection with the fungicide in spraying potatoes. A comparison was made of different strengths of Bordeaux mixture and the 1:11 formula gave slightly better results than the 1:7 mixture. A comparison was also made in which plants were sprayed 5 times with Bordeaux mixture at the rate of 100 gal. and others at the rate of 50 gal. per acre. The increased yield where the greater amount of fungicide was used more than paid for the additional expense.

Black rot and grape stocks, E. RATOIN (*Rev. Sci., 4. ser., 8 (1897), No. 25, pp. 786–788*).—The author cites the resistance of certain varieties to phylloxera and to anthracnose, and mentions the difference in susceptibility of different varieties to black rot. Investigations along the line of resistant varieties is thought promising.

A general review of the investigations on the grain rusts of Sweden, J. ERIKSSON (*Bot. Centbl., 72 (1897), Nos. 10, pp. 321–325; 11, pp. 354–362*).—The substance of this article has been given elsewhere (see p. 760).

On the prevention of grape mildew (*Ztschr. Pflanzenkrank., 7 (1897), No. 5, p. 312*).—A brief note is given on the beneficial use of copper sucrate and sulphur for the prevention of grape mildew.

Does it pay to spray potatoes? F. H. HALL (*New York State Sta. Bul. 123, popular ed., pp. 6*).—A popular edition of Bulletin 123 of the station (see above).

Preventive treatment of raspberry anthracnose, F. H. HALL (*New York State Sta. Bul. 124, popular ed., pp. 5, fig. 1*).—This is a popular edition of a more technical bulletin of the same number (see p. 762).

ENTOMOLOGY.

The California vine hopper, E. W. HILGARD (*California Sta. Bul. 116, pp. 14, figs. 4*).—Though not so seriously injurious as the Anaheim disease or the phylloxera, the vine hopper is thought of great importance on account of its wide distribution and the absence of any thoroughly good remedy. The lack of a remedy for this insect is accounted for by the peculiarities of its life history. In California in the winter, for instance, the egg state is passed in the ground; nor does the adult insect winter where it may be readily attacked. At that season it leads a somewhat active life, feeding on everything that remains green. The insects begin to increase in the spring and are ready for the vines as soon as they leaf out. By summer the insects have gradually left other plants and accumulated on the vines. The older and weaker insects die off, reducing the numbers for a while; then about the first of June the first brood reaches maturity, and from this time on the numbers increase again.

The injury to the plant is explained as due to the loss of water from the continual leakage caused by the insect's punctures, which removes the tension necessary to the growth of the plant, and causes premature ripening and loss of the leaves.

The remedies noted are turning sheep into the vineyard, destroying leaves, plowing and rolling, winter spraying, summer spraying, jarring, the use of the hopper dozer, and the net. The first and favorite remedy is not thought worthy of recommendation. There is said to be no evidence in favor of its employment. The second remedy is considered equally worthless. The third may destroy a few, but the results will not justify the expense. Winter spraying is worthless; summer spraying, although effectual, scarcely pays when the difficulty and cost are taken into consideration. In such spraying a strong wash, like kerosene emulsion, must be used. Jarring is one of the best methods, and several pieces of apparatus for use in this method are figured. In California the favorite apparatus resembles a large scoop with a net in front and with the hind edge bent to receive the handle. The use of a large insect net is also recommended.

The plan of trying to exterminate the insects has been found by repeated trials to be impracticable, and, since it is only the excessive numbers of the insects that are injurious, the author proposes the plan of merely trying to reduce the numbers below the danger line—about 50 per cent in the worst years.

"According to the best estimate we could make by actual trial in the field of the effect of the use of the net in the spring, it appeared that a much larger percentage than that could be destroyed—nearer 90 per cent, and this, to, while working at a rate of about 5 acres a day. About half of a gang of men, green hands at the business, part white and part Chinese, did almost as well as one skilled with the net. At the rate of wages they were getting, the cost per acre would be between 15 and 20 cts. This makes it a wonderfully cheap process. If it cost twice as much, and had to be done a dozen times a year, it would not begin to cost as much as the loss to a crop in a bad year. It seems to have been proven by actual test that a good percentage of the hoppers can be taken and killed by the use of the net and at a cost per acre that is nominal. There yet remains to be seen whether the vineyardist can develop a judgment that is to be depended on as to when the insects are approaching the danger point, and to set the nets going. According to this new theory of treatment, it would appear that we have the true solution of the problem and that the net or the palm-leaf fan are the means giving the greatest promise."

Insects of the prune, A. B. CORDLEY (*Oregon Sta. Bul. 45, pp. 99–127, pls. 3, figs. 4*).—This bulletin was compiled to enable Oregon fruit raisers to recognize the various insects that attack the prune. Although prunes have been grown in Oregon for some years the insects that affect the trees elsewhere are only beginning to be introduced. It is thought that native insects may soon learn to attack them. The insects mentioned are classified according to the part of the tree affected. In some cases very complete accounts of the life history and habits of the insects are given, together with the principal, more or less well-known, remedial measures.

The peach tree borer (*Sanninoidea exitiosa*) promises to be one of the worst insect enemies of the prune in the State. It was introduced into the State nearly 20 years ago and is spreading rapidly. The Pacific peach tree borer (*S. opalescens*) is thought to be present in the State and to take the place of *S. exitiosa* in southern Oregon. The flat headed apple tree borer (*Chrysobothris femorata*), the cicada (*Platypedia putnami*), the branch and twig borer (*Polycaon confertus*), the San José scale (*Aspidiotus perniciosus*), the bud moth (*Tmetocera ocellana*), the clover mite (*Bryobia pratensis*), the red spider (*Tetranychus* sp.), the prune leaf weevil (*Tricolepis inornata*), plant lice (*Aphis prunifoliæ* and *Phorodon humuli*), the peach twig moth (*Anarsia lineatella*), and the box elder plant bug (*Leptocoris trivittatus*), are the other prune pests mentioned.

The bud moth appears to be recorded for the first time in Oregon, where it has been found at Portland affecting the cherry. Although it has not been found affecting prunes, it is included in the list on account of its well-known fruit habits in the East. The remedy suggested for it is under-spraying the leaves with Paris green between June 1 and 10.

The peach twig moth has been found affecting both peach trees and prunes. The insect was studied somewhat in detail. It was noted that notwithstanding a rather extensive attack of the insect in June no evidence was found during the summer, fall, and early winter months of an attack on the prune by a second brood. From this and the fact that in early fall strawberry plants were very badly attacked by an apparently identical larvæ the author infers that the July brood of moths deposits its eggs almost entirely upon the strawberry. A specimen of the moths raised from larvæ taken from the strawberry was identified by C. H. Fernald as *Anarsia lineatella*. The appearance of the moths from larvæ affecting the prune and those from larvæ affect-the strawberry is almost the same, save that the former are somewhat larger and darker in color. The habits of the moths and the coloration of the larvæ are, however, very different and therefore the author thinks that 2 distinct insects have been confused under the name *Anarsia lineatella* or that dimorphism occurs. Which is the true *A. lineatella* is a question left undetermined, but it is suggested that one of the species may possibly be *A. pruinella*, which has been discarded as a synonym of *A. lineatella*. The moths reared from strawberry crowns crawl down the vines into the crevices in the soil and when disturbed run or flutter about with wings half spread, while moths from larvæ affecting the prune take an elevated position in the breeding cage with the fore part of the body somewhat raised and the labial palpi held rigidly upward. When disturbed they dart rapidly away and alight again in the same peculiar attitude.

Winter spraying with strong kerosene emulsion, or a lime-salt-sulphur wash is recommended for destroying the half-grown larvæ in their winter quarters. The best remedy is thought to be spraying with Paris green when the leaf buds are unfolding.

Report upon insect pests found in the Northern District, W. W. FROGGATT (*Agr. Gaz. New South Wales, 8 (1897), No. 10, pp. 716–720, pl. 1*).—Among the large number of injurious insects mentioned, the most important from the amount of damage done is the maize moth (*Heliothis armigera*), which was found in several fields attacking corn to the extent of 75 per cent; the silver spotted plusia (*Plusia verticillata*); the orange pest (*Monolepta rosæ*); the harlequin fruit bug (*Dindymus vericolor*); the larvæ of a moth, probably *Conogethes punctiferalis;* the castor oil plant pest (*Achæa melicerata*); and the fruit fly (*Tephritis tyroni*).

The destruction of magpies, larks, and fly catchers is deprecated since they all feed upon the maize moth.

The castor oil tree moth (*Achæa melicerata*) is described and figured. The larvæ strip the plants of foliage, and when ready to pupate make their way into the stalks. The moth ranges widely, being found in India, Ceylon, Celebes, and Moreton Bay, Queensland. Balfour, in his work on the "Agricultural Pests of India," says: "The larva is called *Thondala hoola* by the Canarese. They feed upon the castor oil plants, the leaves and flowers of which they eat; on 2 or 3 acres of land, in one night, they will leave nothing but bare branches. The plants seldom survive their attack, and at best yield only one-fourth of the produce. The cultivators drive them from the plants by smoking, but this is impossible of application when seeds are sown on an extensive area, in which case the husbandman gives up all hopes of the crop."

The caterpillar is about 1½ in. long, of a general reddish chestnut with a darker chestnut stripe on either side. The head is mottled with creamy white spots. The legs are reddish yellow, claws black, the claspers blotched with white. The caterpillars exhibit considerable variation in color.

The acacia pod moth (*Arotrophora ombrodelta*) is also described. The larvæ were found infesting the pods of the ornamental acacia (*Acacia farnesiana*). The larvæ were plentiful in the pods in May, and were found pupating in June. The moths emerge in August. The only way to get rid of the pests is to collect all pods as soon as ripe and treat them with bisulphid of carbon.

How flowers attract insects: Experimental researches, F. PLATEAU (*Bul. Acad. Roy. Sci. Belg., 3. ser., 33 (1897), pp. 17–42*).—The author briefly reviews some of the literature that has appeared on this subject and gives the results of experiments of his own along the same line. In general he concludes that insects manifest neither preference nor antipathy for the colors of the flowers of any particular species or related species. They go without hesitation to nectarless flowers, habitually neglected, in which honey has been placed. They cease their visits when the nectiferous portions of flowers are removed and begin them again when honey is placed in flowers so treated. The experiments were performed by counting the number of visits per hour to certain flowers. For example, 4 individuals of *Megachile ericetorum* showed no preference for the various colors of *Centaurea cyanus;* the first went from white to blue, from that to purple, and thence to white flowers. The second from white to blue, thence to blue. The third from rose to purple and thence to white. The fourth from blue to rose, to blue, and thence to blue. Similar observations were made in connection with rose, scarlet, yellow, orange, and white varieties of *Dahlia variabilis;* likewise in connection with *Scabiosa atropurpurea, Linum grandiflorum*, and *L. usitatissimum*, and the results compared with those obtained by Darwin with *Dictamnus fraxinella, Delphinium consolida, Primula veris*, and by Bonnier with *Centaurea cyanus, Althea rosea, Digitalis purpurea, Epilobium spicatum*, and *Brassica oleracea.* In regard to color Plateau's results are entirely confirmatory of those obtained by these authors.

The activity of worker bees in the collection of honey, L. DEFOUR (*L'Apiculteur, 40 (1897), No. 12, pp. 300–312, figs. 6*).—The daily and hourly variations in weight of a hive of bees were studied during the season of 1896 with a view to obtaining light on the relations between the going and coming of the workers, the number of bees, the honey collected, etc. The first weight taken in the morning was chosen as the zero point from which to measure the variations. The hourly weights were used in platting curves. As a result of the weighing, it was found that at Fontainebleau there are 2 periods of good honey flow and 2 of bad. The first of the latter begins the season and is followed by the first of the former extending from the latter part of May into June and July. Most of the summer is occupied by the second of the poor periods of honey flow and is followed by the second period of good honey flow, beginning in August and extending into September. The first of the 2 periods of good honey flow is due mostly to acacia and the second to heather bloom. It was also found that during periods of comparatively poor honey flow the daily curve obtained shows peculiar and characteristic features. The bees during the first hour or hour and a half in the morning leave the hive in small numbers and then at the end of this time begin to depart in very large numbers, so that the hive sinks rapidly in weight. Finally a point of minimum weight is reached, after which the weight of the hive begins to increase, slowly at first and then more rapidly. It then begins to decrease again until it reaches in the afternoon a second minimum weight, after which it progressively increases in weight until the evening. By comparison with the experiments by Bonnier on the flow of nectar, Defour comes to the conclusion that this rise in the weight of the hive during the middle of the day corresponds to the period of small flow of nectar, which occurs during the hottest part of the day.

When nectar is abundant, however, there is no such midday rise in the weight of the hive, which shows that the bees go and come continuously throughout the whole day. Further, the rate of departure of the bees from the hive when nectar is abundant is practically the same until the minimum weight is reached.

Bee keeping, F. BENTON (*U. S. Dept. Agr., Farmers' Bul. 59, pp. 32, figs. 19*).—A brief popular treatise on this subject. The results to be expected from bee keeping are candidly set forth. The annual production per colony is given as from 30 to 35 lbs. of extracted, or 20 lbs. of comb honey, worth, according to current prices, from \$2.50 to \$3.00. From this one-third is deducted as a reasonable allowance for labor, etc.

As food plants there are listed the following: Filbert, rape, orchard fruit blossoms, locust, tulip trees, clovers, mustard, asparagus, esparcet, serradella, chestnut, linden, cotton, chicory, pot herbs, alfalfa, parsnips, peppermint, bokhara or sweet clover, cucumber, squash, pumpkin, melon, eucalypti, the carob tree, sachaline, and buckwheat.

Relative to wintering, it is stated that outdoor wintering where conditions are within easy control, even though the preparation for such wintering is greater, is preferable for all except experienced bee keepers who may prefer indoor wintering. The great desideratum in wintering is to retain the warmth of the bees while at the same time preventing the accumulation of moisture in the hive. For securing this a peculiar device of the author's is described, in which the essential features are a single wall of cloth or similar porous material and a space between this and the outer or thick wall filled with waste wool, hay, hemp, or similar material, and the standing of the frames on end to secure deeper comb.

Foul brood and bee enemies are described in the latter part of the bulletin. The best remedy for the former is thought to be the removal of the affected bees, the destruction of the combs, and after first fasting the bees for 48 hours, feeding them for 48 hours with medicated honey or sirup (one part carbolic acid to 600 or 700 parts of honey or sugar sirup) at the rate of ½ lb. daily.

How to cure foul brood among bees, W. McEVOY (*Amer. Bee Jour., 37 (1897), No. 24, pp. 370, 371*).—According to the author's method—which has the advantage of saving the bees and of building up weak colonies, while at the same time curing them—the combs in the honey season are removed from diseased hives in the evening. The bees are all carefully shaken back and then given foundation starters. On this the bees are allowed to work for 4 days. Then in the evening the combs that have been made from the starters are removed and replaced by foundation. This process, according to the author, will completely cure the colony.

Foul broody combs from several hives may be stored in an empty two-story hive, which should be closed up and shaded from the sun. By this time most of the brood will have hatched and the entrance may then be opened and the combs removed and the bees given foundation starters in a single hive. They should then be allowed to build combs for 4 days. At the end of this time in the evening the comb may be replaced by foundation and the bees given a queen cell ready to hatch.

The honey in the diseased combs may be extracted, but all uncapped cells should first be cut out and heated to the boiling point, after which it may be fed back to the bees. All of the foul combs and those built in the 4 days should be buried or placed beyond the possibility of access to the bees.

At the close of the honey season the queens in all the weakest colonies should be caged for about 10 days, so no brood can be started. The brood from strong colonies is then removed and tiered up on the weak ones with the caged queens. The process of giving starters and foundation to the strong colonies is then gone through with and the bees fed sugar sirup in the evening during the first 4 days.

At the end of 10 days the combs from the weak colonies may be removed and the bees shaken into a single hive and given foundation. The queens may now be released and the bees fed sugar sirup for 4 days. The combs at the end of this time are to be removed and replaced by foundation.

Report of the State Board of Agriculture on the extermination of the gypsy moth (*Massachusetts State Bd. Agr. Rpt. 1896, pp. 349–396, pls. 4*).—It is reported that the moth has been exterminated from most of the outlying towns and its spread prevented, but 2 new colonies of long standing having been found in Brookline. According to the opinion of the entomologist, it will take 15 years to exterminate the pest and will require an annual appropriation of $200,000 for 5 years, of $100,000 for the succeeding 5 years, and of $15,000 for the balance of the time.

The field director reports that a line can now be drawn excluding two-thirds of the area formerly infested. This outer area is nearly or not entirely free from the moth.

During the year 10,718,836 fruit, shade, and forest trees were inspected, 57,723 of which were found infested, 567,025 of which were burlapped, 4,327 sprayed, 90,820 trimmed, and 929 scraped. A large number of buildings and fences were also inspected and found infested to a greater or less degree. In all, there were destroyed 1,808,105 caterpillars, 441,899 pupæ, 44,291 moths, and 884,928 unhatched egg clusters. There were found, besides these, 31,501 hatched clusters.

As a forest pest the insect substantiates its former reputation for destructiveness. Oak trees stripped for 2 seasons in succession are now found dead or dying. In a few instances death seems to follow a total defoliation in one year and only a partial one the next. Death seems to begin at the top, the limbs presenting a sunburned appearance. The attacks of bark borers finally hastens the work of destruction.

The methods employed in combating the pest are much the same as in former years. To the list of bird enemies reported in 1895 there are added the red winged blackbird (*Agelæus phœniceus*) and several undetermined species of sparrows. Most of the birds named feed on the caterpillars.

Report of the State entomologist for 1895, J. A. LINTNER (*11th Rpt. of the Injurious and Other Insects of the State of New York for the year 1895; reprinted from the 49th Rpt. New York State Museum, pp. 87–325, figs. 25, pls. 16*).—This contains very complete accounts of some 29 insects. In an appendix there is given a list of insects affecting the apple, which includes 6 species of Hymenoptera, 157 of Lepidoptera, 6 of Diptera, 118 of Coleoptera, 50 of Hemiptera and Homoptera, 3 of Thysanoptera, 2 of Arachnida, etc. The rest of the appendix is devoted to a bibliography of the author's publications.

Worthy of special note among the insects is the plan of destroying the little red ant (*Monomorium pharaonis*) by exploding the vapor of carbon bisulphid introduced into their holes; so also is the statement that the larvæ of the tussock moth (*Notolophus* (*Orgyia*) *leucostygma*) has been found at Albany girdling the young twigs of the American elm ever since the phenomena was first recorded in 1883. During the latter part of August, 1896, twigs of unusual length with perfectly fresh leaves were collected beneath a large American elm. Each had been broken at the base of the girdle, which was near the node of the year's growth. The tips varied in length from 10 to 18 in. and had fallen on account of girdling, not in the early part of the season, but in late summer. In discussing the genista caterpillar (*Mecyna reversalis*) this insect is noted as occurring on Long Island, feeding on a species of genista and cytisus in the greenhouse and also out of doors.

The new insects described are the melon vine midge (*Diplosis cucumeris*), the hairy melon vine midge (*Diplosis setigera*), and an unknown species of *Anthomyia* as a raspberry cane maggot. It is stated that the attack of this insect may be distinguished from that of the raspberry cane girdler by the absence of the 2 rings of punctures between which the egg of the *Obera bimaculatata* is placed, although the tips of the affected twigs bend over in the same manner. A further difference is found in the time of the attack. That of the fly occurs in May and that of the beetle in the latter part of June.

A new mite, the carnation mite (*Tyroglyphus lateromorphous*), is also described. It was found in the greenhouse in Berlin, Massachusetts, where carnations were observed dying gradually at the base. The stems generally began to decay just below the ground. Sometimes the whole plant and at others individual branches would show signs of weakness. An examination of the plant disclosed in most of them, near the surface of the ground, large burrows, in which were found numerous mites of the species named, together with eel worms and several other mites of a larger size, different species and genus (Gamasus). At least 5 different forms of the mite, representing as many developmental stages, were found. The hypopus was found within the body of the female.

The fall army worm: Southern grass worm, A. L. QUAINTANCE (*Florida Sta. Bul. 40, pp. 507–512, figs. 3*).—From several localities in

Florida reports were received that the fall army worm (*Laphygma frugiperda*) has been unusually abundant and destructive during the late spring and early summer of this year. In consequence of these reports the author published this bulletin, which deals briefly with the food plants of the insect, its manner of feeding, noting that in Florida it seems to be partial to crabgrass and to crowfoot. Besides, there is given a description of the insect in its different stages, of its habits, natural enemies, and treatment. Among the insect's enemies the wasp (*Polistes bellicosa ?*) is noted.

Spraying with Paris green at the rate of 1 lb. to 125 to 150 gal. water is advised. If the larvæ are not observed until very much damage is done and the grass is rapidly disappearing, the best remedy then would be to plow them under as deeply as possible. In other cases a large roller might be used to crush the larvæ. Trees may be banded with cotton to prevent the worms from ascending the trunks when their grass food has given out.

Tendons and muscles of Hymenoptera, C. JANET (*Études sur les fourmis, les guêpes, et les abeilles, 12 note. Limoges: (1895), pp. 25, figs. 11; abs. in Jour. Roy. Micros. Soc. [London], 1897, No. 5, pp. 376, 377*).—The author describes the muscles and tendons and articular membranes of bees, ants, and wasps. Each muscle fiber he considers as multi-nucleated, the sarcolemma representing the cell membrane.

The palps of butterflies, E. REUTER (*Acta Soc. Fenn., 22 (1896), pls. 6; Ann. Mag. Nat. Hist., 6. ser., 20 (1897), pp. 114, 115; abs. in Jour. Roy. Micros. Soc. [London], 1897, No. 5, p. 376*).—The author studied the palps of 670 species of butterflies belonging to 302 genera. Special attention was given to external form, the hairy or scaly covering, and the basal spot—which is striated, pitted, and studded with numerous conical hairy scales. The results obtained are used in an endeavor to erect a genealogical tree. The Hesperiidæ are given distinct subordinal rank under the term Grypocera.

The natural history of ants, C. JANET (*Paris: Société Zoologique de France, 1896, pp. 36; abs. in Jour. Roy. Micros. Soc. [London], 1897, No. 5, pp. 374, 375*).—This is a lecture on the habits and life history of ants. As a type *Myrmica rubra* is chosen, and successive stages in the life of the individual described. As a change in the animal's habits it is noted that while many larvæ spin a cocoon, others of the same species do not. The subject of polymorphism is discussed and the functions and status of the queen and workers compared with those of bees and wasps. After the nuptial flight, the males are allowed to die or are killed, while such females as may be found are brought back to the nest to add to the number of its queens. Various types of nests are described and cases cited where 2 colonies apparently nested together. Such cases may be mere accidental juxtaposition or it may be true association. There may be also double nests formed by 2 different kinds of ants, as where *Solenopsis fugax* makes its small galleries within the more massive walls of the nest of *Formica fusca* and steals and devours the latter's nymphs. There may be also genuine mixed colonies. Directions are given for making artificial nests, etc.

The Embiidæ, B. GRASSI (*Quart. Jour. Micros. Sci. [London], n. ser., 40 (1897), pp. 55–75; abs. in Jour. Roy. Micros. Soc. [London], 1897, No. 5, p. 372*).—As an appendix to his memoir on the termites the author gives the results of a study of this family of insects. The external features of the larvæ and adult male and female *Embia solieri* are described in detail. No trace of wings is found in either insect at any stage. The insects live in silken galleries which they construct under stones and in the ground underneath. The silk is extruded as a liquid from the anterior legs and the formation of a gallery takes from 12 to 15 hours time. The insects become adult about the middle of June and pair at the end of the month and die off during the summer. An account is given of the internal anatomy of *Embia eurichii*. The Embiidæ are regarded as interrelated neither with Termitidæ nor Perlidæ; nor do the authors think they have any relation with Psocidæ. According to Grassi they should be ranked as a special suborder parallel with Orthoptera *sensu stricte* under the order Orthoptera. On the other hand the translator of Grassi's papers (which appeared in the original language in 1888-'89) regards them as occupying an intermediate position between Thysanura and cursorial Orthoptera.

On Cuterebra emasculator with descriptions of several allied species, D. W. COQUILLETT (*Canad. Ent., 31 (1898), No. 1, pp. 9-11*).—Five new species are described. They are distinguished by the abdomen being wholly polished, without powder, and with black pleural hairs (*Cuterebra tenebrosa*); by the same features except the pleural hairs, which are mostly yellow, there being only a small patch of black ones in the male (*C. nitida*); by the same characters as the last except the black patch of hairs, which is absent (*C. polita*); by the abdomen being partly opaque pollinose and by a cluster of black hairs above the center of the pleura, the rest being yellowing (*C. lepivora*); and by the same characters as the last except the black hairs, which are absent (*C. latifrons*). Fitch's type (specimen of *C. emasculator*) is stated to be identical with *C. fontinella* of Clark.

The Œdemeridæ of boreal America, G. H. HORN (*Proc. California Acad. Sci., 6 (1896), No. 2, pp. 382-421*).

The fauna of British India, including Ceylon and Burmah, W. T. BLANFORD (*Published under authority of Secretary of State for India; rev. in Nature, 56, No. 1451, pp. 363, 364*).—The twelfth volume of this series. Bees and wasps are treated.

Hymenoptera, C. J. BINGHAM (*London: Taylor & Francis, 1896, pp. XXIX, 579, pls. 4, figs. 188; rev. in Nature, 56, No. 1451, pp. 363, 364*).—Volume 1, treating of bees and wasps.

The production of sound by beetles, S. SCHENKLING (*Illus. Wchnschr. Ent., 2 (1897), No. 18, pp. 273-280, figs. 10*).—The various methods of producing sounds are popularly discussed. Considerable space is given to stridulation in the different groups. The different heads are humming, knocking, clicking, shooting, and stridulating.

On the building and keeping of an insectary, O. SCHULTZ (*Illus. Wchnschr. Ent., 2 (1897), No. 10, pp. 154-159*).

Essay on the general classification of the Lathridiidæ, with a systematic and alphabetic catalogue of all the species of the world, R. P. BELON (*Rev. Ent., 16 (1897), No. 6-7, pp. 157-220; 4-5, pp. 116-156*).

Report of the entomologist, A. D. HOPKINS (*West Virginia Sta. Rpt. 1891, pp. 59-64*).—A report mostly on journeys about the State. Grasshoppers are noted as having appeared in the northern part of the State in considerable numbers; also the cabbage maggot along the Ohio River.

Watering bees—a trough for the purpose, J. C. COREY (*Amer. Bee Jour., 37 (1897), No. 8, p. 115, fig. 1*).—For use in the more or less arid regions of the West, where bees must go a long ways for water, the author's device seems excellent. It consists of a large trough made of a sheet of No. 22 galvanized iron 36 by 84 in. with the side turned up 5 in. high. so as to form a kind of immense dripping pan with a capacity of about 30 gal. In this a lath or cleated float, occupying the whole area, is placed, and pipe connection made with a source of water supply.

Mating queens—how it may be controlled, L. A. ASPINWALL (*Amer. Bee Jour., 37 (1897), No. 26, pp. 402, 403; from Beekeepers' Review for January, 1897*).—Where one has thoroughbred bees at home, the clipping of the wings of the virgin queen so as to lessen somewhat her powers of flight is recommended.

Comb foundation—is its use profitable? S. A. DEACON (*Amer. Bee Jour., 37 (1897), No. 37, pp. 579, 580*).—The author argues that the advantages claimed for foundation do not equal its cost. The only advantage that he is able to see is the exclusion of drone cells. It does not, as was once thought, take 20 lbs. of honey to make 1 lb. of wax but only about 6; and, further, the process of wax formation goes on continually and when foundation is used the small scales of wax accumulate as rubbish on the floor of the hive.

Simmins is quoted as stating that 1 lb. of wax, costing less than 1 shilling 6 pence, fills 8 standard frames with finished comb. To do this with foundation, 1½ lbs. are required, costing at least 2 shillings 6 pence.

The Danzen-Baker hive (*Amer. Bee Jour., 37 (1897), No. 10, pp. 145, 146, figs. 10*).—The main difference from the 10-frame Langstroth hive consists in the hive body being 1⅝ in. deeper and in the arrangement of the frames, etc. The brood frames are closed at the bottom, 7½ by 10 in. in size, and suspended upon a pivot in the middle of the end piece, which allows their being reversed. The super contains 8 holders of four 4 by 5 sections each. These sections are open-cornered—a device which, it is claimed, causes them to be filled out and to look better and bring as much as 2 cts. per pound more. The separators are of cleated slats. Outside of the sections is an air space and over them a layer of paraffin paper held down beneath and covered by several layers of newspapers. In the brood chamber there is also a dead air space about the frame.

Tunis from the point of view of honey production, T. B. BLOW (*Rev. Internat. Apicult., 19 (1897), No. 8, p. 139–142*).—According to the author, in certain districts of Algiers rosemary (*Rosmarinus officinalis*) and heather (*Erica multiflora*) form much the most abundant forage plants and produce great quantities of honey of extra fine quality. They are succeeded by *Calicotome villosa, Thymus munidicus*, etc., and species of cistus. The average production of honey per colony is taken to be 25 kilos, which, for 1,000 colonies, worth 25,000 francs, and allowing 35 per cent for care and 15 per cent for interest, gives an annual profit of 50 per cent.

Mosquitoes and fleas, L. O. HOWARD (*U. S. Dept. Agr., Division of Entomology Circ. 13, 2. ser., pp. 5*).—This is a revised edition (E. S. R., 8, p. 61). Since the publication of the original edition 9 species of mosquitoes have been noted as occurring within the United States, thus raising the number recorded to 30.

The army worm and wheat fly, C. B. WALDRON (*North Dakota Sta. Rpt. 1896, pp. 20–22*).—Notes that the army worm (*Leucania unipuncta*) did considerable damage in Pembina and Walsh counties during 1896; and also a general attack on wheat fields by an insect that is either the Hessian fly or frit fly. The latter insect has never been noticed in the State in such numbers as during 1896.

Recent observations on the cecidomyid galls of the larches, C. VON TUBEUF (*Forstl. Naturw. Ztschr., 6 (1897), pp. 224–229, figs. 2; rev. in Zool. Centbl., 4 (1897), No. 26, p. 919*).—Cecidomyid galls were found in the neighborhood of Munich on the flower buds of the larch. The morphological changes produced in the tissues were very peculiar.

The contest with the phylloxera, E. BUGNON (*Chron. Agr., Canton Vaud, 9 (1896), No. 11, pp. 263–271*).—Report from the Canton of Vaud to the Grand Council.

The contest with the phylloxera in the Canton of Vaud in 1895, J. DUFOUR (*Chron. Agr. Canton Vaud, 9 (1896), No. 13, pp. 315–318*).—During the year the insect was found in 4 new parishes. A total of 2,028 grape stocks were infested and a total area of 41,350 square meters destroyed.

The phylloxera and American vines, J. DUFOUR (*Chron. Agr. Canton Vaud, 10 (1897), Nos. 12, pp. 331–337; 13, 370–373*).—An extract from the report of the Viticultural Station at Lausanne for 1896. Among other things it is noted that the cost of visiting various vineyards aggregating 6,600 hectares amounted to about $3,550, and required the services of 427 men; that 9 new places of infestation were discovered, and that the grape stocks attacked by the phylloxera numbered 11,958; and that 35,469 square meters of vineyard surface were destroyed.

Contrasting this with previous years, it is noted that in 1892, 839 grape stocks were attacked and 5,496 square meters of vineyard surface were destroyed; that these numbers changed in 1893 to 14,144 stocks and 33,012 square meters; in 1894 to 3,800 stocks and 26,142 square meters; and in 1895 to 2,028 stocks and 41,350 square meters.

Combating peronospora and phylloxera, A. GAWALOWSKI (*Ztschr. Nahr. Untersuch. u. Hyg., 11 (1897), No. 16, pp. 271, 272*).

The green scale of coffee, T. D. A. COCKERELL (*Gard. and Forest, 10 (1897), No. 497, p. 347*).—*Lecanium viridi*, the coffee scale of Ceylon, is recorded as having been found on coffee at São Paulo, Brazil, by Dr. von Ihering.

Biological notes on the pine worm, Panolis piniperda, H. GAUCKLER (*Illus. Wchnschr. Ent., 2 (1897), No. 14, pp. 213–215, figs. 3*).—The feeding habits, etc., are described. In 1895 the larvæ appeared in great numbers in Hesse and did great damage to the pines. Near Lampertheim nearly all the 53-year old pines on about 24 hectares are now dead. In another area of 60 hectares near the same place most of the trees, which are almost 70 years old, are either dry or show but few green needles. The following parasites have been found affecting this insect: *Ichneumon molitorius, I. trilineatus, I. bilunulatus, I. raptorius, I. pallifrons, I. æthiops, I. comitator, I. fabricator, I. metaxanthus, I. nigritarius, I. pinitorum, I. piniperdæ, Cryptus arrogans, C. filicornis, C. intermedius, C. leucostomus, C. longipes, C. seticornis, C. piniperdæ, Phygadenon nigritarius, P. commutatus, Ophion ramidulus, O. luteus, O. meridarius, Anomalon unicolor, A. xanthopus, A. gliscens, A. biguttatum, Pimpla examinator, P. instigator, Heteropelma calcator*, and *Eurylobus tristis*.

Directions for collecting and preserving scale insects (Coccidæ), T. D. A. COCKERELL (*U. S. Nat. Mus. Bul. 39, pt. L, pp. 9*).—The various places and countries where coccidological lists have been made are enumerated and also the countries that still offer fresh fields for the collector. The whole of the East Indian Archipelago, China, Siam, the Malay Peninsula, and Burmah have yet to be explored for coccidæ; also the whole of tropical Africa, the islands of the Indian Ocean, and Madagascar. It is shown that it is important to note the food plant from which scales are collected and brief directions for the recognition, collection, and treatment in the field and in the cabinet are given.

Destruction of the "pyrale" by washing with nitric acid, L. DEGRULLY (*Prog. Agr. et Vit., 28 (1897), No. 51, pp. 697–699*).—The use of nitric acid against the "pyrale" (*Cenophtira pilleriana*) is described as effective and economical and is compared with a wash of sulphate of iron. It is diluted with 6 volumes of water. Thus diluted it is used at the rate of 25 liters of acid to 1,000 plants or 28 liters to 800 plants. At these rates the cost is about 42.37 cts. for the first and 53.77 for the second. Besides forming a good insecticide, the acid, on account of the nitrogen contained, is further commended as a manure. During winter the ground about the base of the vines may be sprayed with the acid, diluted to 1 to 6, as a remedy for the phylloxera.

Recent observations on the employment of nitric acid against the "pyrale," L. DEGRULLY (*Prog. Agr. et Vit., 28 (1897), No. 52, pp. 729, 730*). It is noted that the penetrating qualities of nitric acid used according to the directions given in a preceding note are not as great as might be desired, and further, that it has not yet been determined whether the acid injures the plants.

A bee parasite, H. THEEN (*Illus. Wchnschr. Ent., 2 (1897), No. 16, pp. 242–247, figs. 8*). The history, life history, etc., of *Meloë proscarabæus* is discussed.

A new parasite of the Harlequin cabbage bug, L. O. HOWARD (*Canad. Ent., 31 (1898), No. 1, pp. 17, 18*).—*Encrytus johnsoni*, n. sp., which is closely related to *E. mitratus* of Europe, is described as obtained from eggs of *Murgantia histrionica* in Maryland.

On parasites of insects, K. SAJÓ (*Illus. Wchnschr. Ent., 2 (1897), No. 5, pp. 70–76*).—A general paper noting among other things that the hosts of but few of the recognized parasitic species are known.

FOODS—ANIMAL PRODUCTION.

Human food investigations, H. SNYDER (*Minnesota Sta. Bul. 54, pp. 37–90, figs. 5*).—*The gluten of wheat* (pp. 37–42).—The author points out that the value of flour for bread is dependent upon the total amount of gluten which it contains and upon the proportion of glutenin and gliadin making up the gluten. The total protein, gliadin, and glutenin in a number of samples of American and foreign wheat was determined. The gliadin was obtained by extracting finely ground wheat with 70 per cent alcohol. The glutenin was obtained by extracting with potassium hydroxid solution after first removing all other proteids. In the following table a number of varieties of wheat are compared on the basis of their content of nitrogenous constituents:

Composition of the gluten of wheat.

Variety of wheat.	Source.	Protein (N. + 5.7).	Proteids in gluten.	Gliadin.	Glutenin.	Gluten in form of— Gliadin.	Gluten in form of— Glutenin.
		Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Scotch Fife	Minnesota Station	14.76	12.46	7.26	5.20	58.3	41.7
Wellman's Fife	do	12.60	10.18	6.14	4.04	60.3	39.7
Red Winter Wheat		10.73	8.68	5.60	3.08	64.5	35.5
Early Genesee Winter		7.98	6.31	3.71	2.60	58.8	41.2
Ladoga	Manitoba	9.54	8.25	5.64	2.61	68.5	31.5
Blue Stem	Minnesota Station	14.20	11.75	7.84	3.91	66.7	33.3
Crimean	Russia	11.08	9.49	5.77	3.72	60.8	39.2
Frosted Spring Wheat		12.88	6.39	4.25	2.14	66.5	33.5
Calcutta	India	8.13	6.70	4.90	1.80	73.1	26.9
No. 1 Chile	Chile	7.01	5.62	2.92	2.70	52.0	48.0
La Plata	Argentine Republic	13.38	11.84	4.99	6.85	42.1	57.9
Nicolaeff Azima	Russia	10.28	8.74	5.70	3.04	65.2	34.8
Oregon White Winter	Chicago market	9.23	7.65	5.42	2.23	70.8	29.2
No. 2 Red Winter Wheat.	do	7.01	5.56	3.77	1.79	67.8	32.2
No. 2 Hard Winter Wheat.	do	8.83	7.31	3.99	3.32	54.6	45.4

"For bread-making purposes the gluten should be well balanced; that is, contain the right proportion of gliadin (binding material) to glutenin. The most valuable wheats for both food and bread-making purposes are those rich in protein, of which 80 to 85 per cent is gluten, and the gluten is composed of about 60 per cent gliadin and about 40 per cent glutenin. . . . In the samples [of Scotch Fife and Wellman Fife], which may be taken as good types of northern-grown hard spring wheat, the gluten contains about 60 per cent gliadin and 40 per cent glutenin. In the so-called soft wheat [Blue Stem Calcutta and Oregon White Winter] there is from 7 to 13 per cent more of gliadin and a correspondingly less amount of glutenin."

Bread was made from (1) flour from which the gliadin had been extracted, (2) flour from which the albumin had been extracted, (3) flour from which proteids soluble in sodium chlorid solution had been extracted, and (4) normal flour. In the first case "the dough was not sticky; it felt like putty and broke off like putty. The yeast caused the mass to expand a little when first placed in the oven, then the top of the loaf began to break apart, and the loaf decreased in size as if no yeast had been used. The loaf, when baked, was about as heavy as the same bulk of rubber." In the second and third cases the bread did not differ materially from that made from normal flour. "The gliadin and glutenin are the only proteids which give character to bread; that is, provided the bread is properly made."

The digestibility of bread (pp. 43–45).—Experiments were made with a man to learn the digestibility of bread made from the best grade of patent spring-wheat flour, from ordinary bakers' flour, and from whole-wheat flour. The subject of the test weighed about 150 lbs., and on each day walked about 4 miles for exercise. About $1\frac{1}{2}$ lbs. of bread, $\frac{1}{5}$ lb. of butter, and $\frac{1}{2}$ lb. of eggs were eaten daily. The author calculates that if the bread were purchased from a baker the cost of a day's food would be $15\frac{1}{2}$ cts., and if the bread were made at home the cost would be about 10 cts. The flour used was analyzed and its composition is reported. In the author's opinion the whole-wheat flour was of an inferior quality. It was purchased as high-grade flour, but had apparently been made from winter wheat deficient in protein. The coefficients of digestibility of the different kinds of bread are shown in the following table:

Coefficients of digestibility of bread.

	Dry matter.	Protein.	Fat.	Carbohydrates.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Bread from patent flour	94	86	87	97
Bread from bakers' flour	93	84	87	97
Bread from whole-wheat flour	93	87	86	97

Composition of bread (pp. 46, 47).—Assuming that bread should be selected for its protein content, the author discusses that made from ordinary flour and from whole-wheat flour. An unfermented bread, which is quite extensively used in many parts of Minnesota under the name of "flat bread," is described. It is made from whole-wheat flour or ordinary flour and baked in the form of large, flat, round cakes. The dough is sometimes rolled very thin before baking. Samples of flat bread made from whole-wheat flour and patent flour were found to have the following composition:

Composition of flat bread.

	Water.	Protein.	Fat.	Carbohydrates.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
From whole-wheat flour	9.38	15.50	0.70	72.92	1.50
Do	9.03	15.63	.60	72.64	1.50
From patent flour	10.54	13.44	.20	75.28	.54

The loss of food value by prolonging fermentation in bread making (pp. 48–51).—Seven tests were made to study the loss of material due to fermentation in bread making. The bread was made according to 2 methods in common use. In 3 trials the short fermentation method was followed. A dough was made of flour, water, and yeast, which was kneaded thoroughly and allowed to rise until it had doubled its bulk, when it was again kneaded and allowed to rise, and then baked. In 4 trials the fermentation was more prolonged. A batter was made from flour, yeast, and water and allowed to ferment over night, usually 10 to 15 hours. More flour was then added, the dough was kneaded and allowed to rise a second time. It was then treated as by the first method. By the second method a much smaller quantity of yeast was used than by the first method and the fermentation was carried on at a lower temperature. The flour, yeast, and bread were weighed and analyzed and the results are tabulated. All the flour used was from the same lot of patent flour made from hard spring wheat.

"When the bread was made by the short fermentation process, there was a loss of 1.74 per cent of dry matter, equivalent to a loss of a little more than 3 lbs. of flour per barrel. When the bread was made by the prolonged fermentation process there was a loss of 8.08 per cent of dry matter, equivalent to a loss of about 14½ lbs. of flour for every barrel of flour used.

"When the bread was made by the short fermentation process there was an average loss of 2.10 per cent of the total nitrogen; with the prolonged fermentation process the loss of nitrogen was 7.77 per cent. When a barrel of flour is made into bread by the prolonged fermentation process, the loss of nitrogen exceeds the loss by the short fermentation process in protein value equal to about 7 lbs. of the best sirloin steak."

The digestibility of potatoes and losses of food values when potatoes, carrots, and cabbages are boiled in different ways (pp. 52–57).—This is a brief account of work reported in Bulletin 43 of this Office (E. S. R., 9, pp. 677, 679).

The rational feeding of men (pp. 60–90).—The author summarizes in a general way the results of numerous investigations, and briefly discusses the general laws of nutrition. The composition of a large number of foods and the amounts and composition of different foods which can be purchased for 10 cts. are quoted.

Studies of dietaries, W. O. ATWATER and A. P. BRYANT (*Connecticut Storrs Sta. Rpt. 1896, pp. 117–158*).—This is a continuation of work previously reported by the station (E. S. R., 8, p. 419). The results of 9 dietary studies hitherto unpublished are reported in full. A summary follows:

Results of dietary studies—food eaten per person daily.

	Cost.	Protein.	Fat.	Carbohydrates.	Fuel value.
	Cents.	*Grams.*	*Grams.*	*Grams.*	*Calories.*
Poor family in Connecticut	14	87	75	509	3, 140
Laborer's family in Connecticut	16	108	100	433	3. 165
Farmer's family in Connecticut	....	94	177	406	3, 695
Do	....	96	139	356	3, 145
Station agriculturist's family	....	104	105	433	3, 180
Private boarding house in Connecticut	27	92	119	339	2, 875
Farmer's family in Vermont	9	89	117	449	3, 295
Man in the Adirondacks in midwinter	46	200	216	367	4, 335
Camping party in Maine *a*	....	172	261	533	5, 3[illegible]

a The figures represent the quantities purchased.

The results of previous studies reported by the station are quoted, and from them and the above studies a number of averages are deduced.

Dietary study of Sandow, the "strong man," C. F. LANGWORTHY and W. H. BEAL (*Connecticut Storrs Sta. Rpt. 1896, pp. 158-162*).—The food consumed in a day by Sandow, the professional "strong man," was weighed and its composition calculated. The nutrients consumed were protein 244 gm., fat 151 gm., and carbohydrates 502 gm. The energy of the food was calculated to be 4,462 calories. The nutritive ratio was 1:3.4.

"It will be seen that while the amount of carbohydrates and fat consumed does not differ very greatly from the standard for a man at muscular work, the amount of protein is very large and the nutritive ratio is very narrow.

"The fact that so much protein is consumed is of especial interest."

The digestibility of different classes of food materials, W. O. ATWATER (*Connecticut Storrs Sta. Rpt. 1896, pp. 186-190*).—On the basis of results of a large number of digestion experiments made by different investigators, the author deduces the following average coefficients of digestibility for animal foods, cereals and sugars, and vegetables and fruits:

Average coefficients of digestibility.

	Protein.	Fat.	Carbohydrates.
	Per cent.	*Per cent.*	*Per cent.*
Animal foods	98	97	100
Cereals and sugars	85	90	98
Vegetables and fruits	80	90	95

The coefficients of digestibility of protein, fat, and carbohydrates as actually determined by the author in the experiments with man cited below were compared with the above calculated results for the same food materials. The agreement was found to be very close, as is shown by the following table:

Comparison of determined with average coefficients of digestibility.

	Protein.	Fat.	Carbohydrates.
	Per cent.	*Per cent.*	*Per cent.*
As found by experiment	93.7	95.3	97.7
As calculated	94.0	96.3	98.1

"This close agreement implies that the assumed coefficients fairly represent the proportions of nutrients that are digested, under ordinary normal conditions, from such food materials as those used in these experiments."

Experiments on the digestion of food by man, W. O. ATWATER (*Connecticut Storrs Sta. Rpt. 1896, pp. 163-180*).—A number of digestion experiments with single food materials and a mixed diet were made under the direction of the author by the usual methods, which have been described in detail in a previous publication.[1]

The fuel value of the food, urine, and feces was determined. The fact is pointed out that the fuel value of the food minus the fuel value of the feces does not represent the energy which is available for the organism, since nitrogen is excreted in the form of urea.

"Assuming that all of the digested nitrogen excreted from the body is in the form of urea, we may roughly calculate the amount of the potential energy of protein which thus fails to be transformed into kinetic energy in the body.

"Urea contains 46.67 per cent nitrogen, hence N. $\times$ 2.143 = urea. N. $\times$ 6.25 = protein. Hence protein divided by 6.25 $\times$ 2.143 = the urea corresponding to the protein. The heat of combustion of 1 gm. of urea is 2.53 calories. The fuel value of the urea corresponding to 1 gm. of protein would therefore be $\frac{1}{6.25} \times 2.143 \times 2.53$, or 0.87 calories.

"According to this computation, which is theoretical and but approximately correct, there would be for each gram of digested protein 0.87 calories of energy in the unconsumed urea and other compounds. Subtracting this value from the total fuel value of the digested nutrients the remainder may be assumed to represent the proportion of the total energy of the digested nutrients which becomes actually available to the body. This is designated in the tables as 'net fuel value of the food digested.'"

The results of the experiments are briefly shown in the following table:

Coefficients of digestibility of a number of foods by man.

Subjects and food materials.	Protein.	Fat.	Carbohydrates.	Net fuel value.
Laboratory janitor.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Milk	88.1	97.0	84.4	87.8
Do	90.9	95.5	85.0	89.4
Do	95.6	98.1	89.5	89.3
Wheat bread	91.9	....	99.4	94.6
Do	82.3	....	98.7	92.4
Bread and milk	97.6	98.9	98.9	95.2
Beef round, milk, butter, oatmeal, bread, sugar	94.4	96.7	98.5	93.3
Beef round, eggs, butter, cheese, milk, crackers, bread, potatoes, sugar	95.9	97.4	97.9	93.2
Do	91.8	97.1	98.4	92.6
Chemist.				
Beef round, eggs, butter, milk, bread, potatoes, apples, peaches, pears, sugar	94.9	96.9	98.9	94.1
Physicist.				
Beef round, butter, milk, white bread, brown bread, oatmeal, beans, potatoes, apples, sugar	91.3	95.9	97.7	96.9
Three chemists.				
Mixed diet (meat, eggs, bread, vegetables, fruit, etc)	91.1	96.2	99.2	94.6

"The results of the first 5 experiments are not entirely reliable indications of the actual digestibility of milk and bread as ordinarily eaten, partly because of defects in the experiments themselves, and partly because of the probability that these materials, taken by themselves, are not digested as completely as when they form a part of a mixed diet. . . .

[1] U. S. Dept. Agr., Office of Experiment Stations Bul. 21 (E. S. R., 7, p. 148).

"As regards the variations of digestion of food by the same person under different conditions, the results of inquiry up to the present time lead to the inference that while the digestive apparatus of the subject is in normal condition, and the quantities of food are also normal, the coefficients of digestibility are much less affected by exercise or rest than is commonly supposed. There does seem to be ground, however, for the belief that in ordinary mixed diet the digestion is generally more complete than where only a single food material is eaten."

The digestion experiment with 3 chemists was made in connection with a dietary study published in the Annual Report of the station for 1894 (E. S. R., 7, p. 596). The balance of income and outgo of nitrogen was determined for each of the 10 days of the experiment. The average daily balance was as follows: In food 18.5 gm., in urine 11.9 gm., in feces 1.7 gm.; nitrogen gained 4.9 gm., protein gained 30.7 gm.

"It will be noticed that protein was stored constantly during the experiment, showing that the dietary furnished more of total nutrients and of nitrogenous material than was necessary for nitrogen equilibrium under the circumstances.

"The amounts of food eaten varied from day to day in accordance with the inclinations of the subjects of the experiments. This doubtless explains in large part the daily variations in the nitrogen excretion."

Two digestion experiments with an infant, A. P. BRYANT (*Connecticut Storrs Sta. Rpt. 1896, pp. 181–185*).—Two digestion experiments with an infant were made in connection with dietary studies previously reported by the station (E. S. R., 8, p. 419). In the first test the food consisted of cows' milk alone and in the second of cows' milk, oatmeal, and sugar. The child was about 9 months old. The results are briefly shown in the following table:

Coefficients of digestibility of milk and milk, oatmeal, and sugar.

	Total organic matter.	Protein.	Fat.	Carbohydrates.	Ash.	Available fuel value.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Milk	91.5	93.8	95.7	83.3	51.6	86.3
Milk, oatmeal, and sugar	95.6	95.3	98.4	93.7	60.9	91.0

The results obtained are discussed at length and compared with similar results obtained by other investigators.

"It may be of interest to note here that a rough qualitative test showed but a comparatively small amount of calcium salts and of phosphoric acid in the feces, while the ash of the milk and of the oatmeal contained these substances in relatively large amounts."

The influence of borax and boric acid upon nutrition, with special reference to proteid metabolism, R. H. CHITTENDEN and W. J. GIES (*Amer. Jour. Physiol., 1 (1898), No. 1, pp. 1–39*).—The authors report 3 experiments with a dog. A period in which borax or boric acid was given was preceded and followed by a normal period. The balance of income and outgo of nitrogen was determined; also the specific gravity of the urine, its reaction, and content of uric acid, total and combined sulphur, and total phosphoric acid. The principal conclusions reached were as follows:

Moderate doses of borax, up to 5 gm. per day, were continued for some time without influence on proteid metabolism, while doses, 5 to 10 gm. daily, had a direct stimulating effect. Boric acid, in doses up to 3 gm. per day, was practically without effect on proteid metabolism and the general nutrition of the body. Large doses of borax tended to retard the assimilation of protein and fat, increasing noticeably the weight of the feces and their nitrogen and fat content. Boric acid, on the contrary, in doses up to 3 gm. was without direct influence in this regard. Borax and boric acid are quickly eliminated from the body through the urine, 24 to 36 hours being generally sufficient for the purpose. They are rarely found in the feces. Neither has any influence on the putrefactive processes in the intestines. No abnormal symptoms in the urine were observed, neither sugar nor albumen being found. Owing to their rapid elimination no marked accumulative effect can result from the daily consumption of borax and boric acid in moderate quantities.

These experiments are of importance, in view of the fact that borax and boric acid are used as food preservatives.

Digestion experiments with sheep, C. S. PHELPS and A. P. BRYANT (*Connecticut Storrs Sta. Rpt. 1896, pp. 246–272*).—This is an account of work in continuation of that reported in the Annual Report of the station for 1895 (E. S. R., 8, p. 422). Eighteen experiments are reported. They were made by the usual methods followed at the station. The results are briefly given in the following table:

Average coefficients of digestibility of feeding stuffs.

	Number of tests.	Organic matter.	Protein.	Fat.	Nitrogen-free extract.	Fiber.	Ash.	Fuel value available.
		Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Field-cured clover rowen	2	59.3	62.7	59.4	63.6	49.1	44.1	53.8
Barn-cured clover rowen	2	58.9	66.9	60.2	61.9	45.6	47.4	53.6
Rowen	4	66.4	69.0	48.6	67.2	66.6	40.1	60.6
Do	2	67.4	67.1	55.2	71.6	62.6	46.2	61.8
Oat hay	4	50.1	55.3	61.3	51.6	43.5	34.6	46.3
Rowen and coarse bran	4	63.7	69.6	60.9	67.2	49.0	29.9	58.6
Rowen and wheat middlings	4	68.9	72.9	70.7	71.7	55.5	32.8	64.0
Oat fodder *a*	1	56.5	67.8	67.5	61.1	43.5	49.1	53.2
Do	2	61.8	72.3	70.2	63.5	54.6	66.4	58.2
Oat and pea fodder *a*	1	62.9	73.2	70.3	66.9	49.1	41.9	59.9
Do	2	66.0	79.6	69.7	61.5	63.8	58.9	61.7
Millet fodder	1	61.8	57.3	59.8	64.4	58.8	58.1	57.8
Barnyard millet	2	65.4	47.2	71.7	68.4	62.8	52.7	62.4
Soy bean fodder *a*	2	62.6	77.2	50.1	70.9	47.3	24.8	56.2
Do	2	67.1	75.2	57.7	76.4	49.8	22.7	61.8
Sweet corn fodder	2	68.9	60.7	71.4	73.5	59.4	53.0	64.8
Cowpea fodder *a*	2	72.1	77.2	59.3	77.0	61.7	21.6	66.2

a Fed green.

The action of certain bodies on the digestive ferments, F. D. SIMONS (*Jour. Amer. Chem. Soc., 19 (1897), No. 9, pp. 744–755*).—The author reports a number of experiments on the effect of picric acid, tropæolin 000, metanil yellow, Bismarck brown, cinnamon (10 parts oil of cinnamon and 90 parts alcohol), formol, salicylic acid, wintergreen, peppermint, chrysoidin, saffranin, and methylene blue on pancreatic and peptic digestion. Different quantities of the several substances were added to solutions of peptic and pancreatic ferments and the effect on digestibility of albumen was observed. It was found that picric acid, tropæolin 000, and metanil yellow hindered peptic digestion; Bismarck brown, cinnamon, and formol hindered pancreatic digestion; wintergreen and salicylic acid partially arrested peptic digestion; and peppermint, chrysoidin, saffranin, and methylene blue had no apparent effect on the action of either of the ferments.

Silage for hogs, D. O. NOURSE (*Virginia Sta. Bul. 68, pp. 101–105*).—Two tests were made to study the value of silage in a maintenance ration for pigs. The first was made with 2 lots of sows. Lot 1 consisted of a Poland-China and a Berkshire, and lot 2 of 2 Poland-Chinas. The pigs in lot 1 were fed per week 17½ and 14 lbs., respectively, of corn on the cob. Those in lot 2 were fed 56 and 49 lbs. of silage per week, respectively. Some of this (about 10 lbs.) was wasted, but the amount was not accurately determined.

During the 7 weeks of the test lot 1 lost 3.5 lbs. and lot 2 27 lbs. The pigs were in poor condition at the close of the test. Reckoning silage at $2 per ton and corn at 35 cts. per bushel, the silage was much the cheaper food. The animals were fattened after the close of the test, and no difference was observed in the 2 lots.

In the second test the value of silage as part of a ration was studied. A boar and a sow were each fed about 21 lbs. of corn on the cob and 35 lbs. of silage per week; another sow was fed 14 lbs. of corn on the cob and 28 lbs. of silage. During the 10 weeks of the test the boar lost 18 lbs., and the sow fed the same ration lost 6 lbs., while the sow fed the smaller ration gained 13 lbs. The pigs appeared in good condition.

On the basis of the values mentioned above the pecuniary value of silage is discussed. "So far as the above results are concerned, we should say silage was economical to use in conjunction with corn as a maintenance ration, but not so if used alone."

Feeding experiments with chickens, T. D. HINEBAUCH (*North Dakota Sta. Rpt. 1896, pp. 16–18*).—Brief statements are made concerning the condition of the poultry department at the station.

A test was made to determine whether heating a poultry house diminished the cost of feeding and increased the egg production. Forty-six chickens were fed in an unwarmed poultry house from December 1 until January 20. At the beginning of the test they were fed 5 lbs. of table scraps in the morning and 2 lbs. of wheat screenings at night. Afterwards the ration was increased until they consumed 11¾ lbs. of scraps in the morning and 11½ lbs. of wheat screenings in the evening.

From January 20 until March 31 the poultry house was heated by means of a stove. At the end of January only 6 lbs. of scraps were consumed in the morning and $8\frac{3}{4}$ lbs. of screenings in the evening. At the close of the test the morning ration consisted of $4\frac{1}{2}$ lbs. of table scraps, and the evening ration of $4\frac{3}{4}$ lbs. of wheat screenings. The total cost of the fuel was $4.50.

During the month of January, before the artificial heating was begun, the average number of eggs produced was $2\frac{3}{4}$ per day, and during the remainder of the month the average was $6\frac{2}{11}$. That is, when the poultry house was heated about half as much food was consumed and the egg production was more than doubled. With eggs at 25 cts. a dozen and food at the usual price, heating the poultry house proved profitable.

A second test extending from December 1 to June 1 was made with 2 lots of pullets to compare rations for laying and breeding stock. Lot 1 consisted of 16 and lot 2 of 19 pullets. Both lots were fed under the same conditions of temperature, housing, etc. Lot 1 was intended for breeding, and it was therefore desirable that they should not lay until late in the season, and that the egg production should then be regular. They were fed wheat screenings and corn. Lot 2 were fed for egg production, it being desirable that as many eggs should be produced as early in the season as possible, while the price was high. The pullets in this lot were given boiled lean meat and scraps from the table from which the fat had been removed. At night they were fed wheat screenings *ad libitum*, and twice a week corn was fed in addition. Water was supplied in abundance. The wheat screenings used in this test were of a better quality than those fed lot 1.

At the end of March it was desired that lot 1 begin to lay for breeding purposes, and from this time until the close of the test they were fed a ration similar to that fed lot 2. The egg production of lot 1 by months was as follows: December, 0: January, 7; February, 12; March, 43; April, 189; and May, 381. The average per pullet for the whole test was 150.5 eggs. Before the rations were changed the pullets had the appearance of being over fat.

The egg production of lot 2 by months was as follows: December, 63; January, 124; February, 109; March, 168; April, 129; and May, 142. The average per pullet for the whole test was 153 eggs.

The eggs produced during the earlier part of the season sold for a higher price than those produced later.

Bread making, MARIE B. SENN (*North Dakota Sta. Rpt. 1896, pp. 43–46*).—A number of experiments were made and the amount of flour required of different sorts with a definite quantity of yeast, etc., was recorded. The other ingredients remaining the same, the amount of flour necessary for making bread varies with its gluten content.

The pure food question in Pennsylvania, L. WELLS (*Pennsylvania Dept. Agr. Bul. 3, pp. 37*).—A discussion of the manufacture and sale of oleomargarin and other adulterated food products, with text of laws and decisions of the Supreme Court of the State of Pennsylvania pertaining thereto.

Pure food and dairy laws of Pennsylvania, L. WELLS (*Pennsylvania Dept. Agr. Bul. 32, pp. 25*).—A summary of the several acts of the Assembly relating to foods and dairy products, with decisions of the courts in regard to the same.

Subsistence and messing in European armies, J. R. WILLIAMS, C. DE W. WILCOX, C. REICHMANN, and L. C. SCHERER (*War Dept.* [*U. S.*], *Adjt. Gen. Office, Mil. Infor. Div., 16, I, pp. 91*).—A compilation of information concerning the food in times of peace and war of the armies of Austria, Belgium, England, France, Germany, Holland, Italy, and Switzerland.

Soy beans as food for man, C. F. LANGWORTHY (*U. S. Dept. Agr., Farmers' Bul. 58, pp. 20–23*).—Soy beans as food for man are discussed with special reference to the food preparations made from them in China and Japan.

The average composition of American food materials, W. O. ATWATER (*Connecticut Storrs Sta. Rpt. 1896, pp. 190–198*).—This is a condensation of Bulletin 28 of this Office (E. S. R., 8, p. 426).

Analyses of fodders and feeding stuffs, W. O. ATWATER and F. G. BENEDICT (*Connecticut Storrs Sta. Rpt. 1896, pp. 273–287*).—In connection with the work of the station during the year analyses were made of the following feeding stuffs: Timothy (*Phleum pratense*), orchard grass (*Dactylis glomerata*), meadow fescue (*Festuca elatior*), brome grass (*Bromus inermis*), red top (*Agrostis vulgaris*), millet fodder, cowpea fodder, oat fodder, oat and pea fodder, rowen, sweet corn fodder, soy bean fodder, corn silage, corn stover, clover hay, clover rowen, meadow-grass hay, millet and Hungarian hay, oat hay, swamp hay, yellow and white flint corn, oats, corn meal, Buffalo gluten feed, Chicago gluten feed, linseed meal, wheat bran, and wheat middlings.

Proportions of digestible nutrients in food materials, W. O. ATWATER (*Connecticut Storrs Sta. Rpt. 1896, pp. 199–204*).—Using the coefficients of digestibility noted (see p. 780) the digestible nutrients in a large number of American food materials were calculated.

Investigations on metabolism in the human organism, W. O. ATWATER, C. D. WOODS, and F. G. BENEDICT (*Connecticut Storrs Sta. Rpt. 1896, pp. 85–116*).—This is an account of experiments which were reported in Bulletin 44 of this Office, and are also briefly mentioned in E. S. R., 8, p. 821.

Proceedings of the first convention of the Society for the Rational Feeding of Farm Animals (*Compt. Rend. 1er. Congrès Soc. Aliment. Rat. Bétail, 1897, pp. 136*).—In addition to a report of the routine business, there are included papers by a number of investigators on animal production and feeding of young animals; the feeding of draft animals, dairy cows, and animals for market; the toxic properties of certain feeding stuffs; methods useful in practical experiments in feeding animals; and the adulteration of feeding stuffs.

The relation between the rate of growth of the young of different mammalia to the composition of milk, F. PRÖSCHER (*Ztschr. Physiol. Chem., 24* (*1897*), *No. 3, pp. 285–302*).

Studies on the hornless cattle of North Europe, with special reference to the North Swedish Fjell cattle, together with investigations on the cause of loss of horns, E. O. ARENANDER (*Ber. Physiol. Lab. Landw. Inst. Halle, No. 13, pp. 43–184, pls. 6, map 1*).

DAIRY FARMING—DAIRYING.

A study of rations fed to milch cows in Connecticut, W. O. ATWATER and C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1896, pp. 53–84*).—This is a report of the fourth winter's work on this subject (E. S. R., 8, p. 430), together with a summary of the results previously obtained.

Two herds of 11 and 13 cows, respectively, were tested for 12 days with reference to the food eaten and the milk and fat produced, and then in a transition period of 9 days a change was made to a more nitrogenous ration, suggested by the station, and the herds tested for a second period of 12 days. Full data for the tests are given, from which the following summary is taken:

Original and suggested rations fed to cows on 2 farms in Connecticut.

Herd.	Ration.	Average daily ration per 1,000 lbs. live weight.				
		Digestible protein.	Digestible fat.	Digestible carbohydrates.	Nutritive ratio.	Fuel value.
		Pounds.	*Pound.*	*Pounds.*		*Calories.*
A	Original	1.84	0.72	14.99	1:9.0	34,350
	Suggested	2.93	.64	13.02	1:4.9	32,400
B	Original	3.13	.72	15.94	1:5.6	38,500
	Suggested	3.66	.97	14.21	1:4.5	37,350

"The total cost of the ration [of herd A] remained practically the same, but the net cost was greatly reduced in the second test, owing to the higher value of the manure. The average daily yield of milk was increased during the second test 0.7 lb. and the butter 0.05 lb. over that obtained in the first test. The total cost of feed to produce 100 lbs. of milk was reduced 4 cts. and the cost of feed for a pound of butter was reduced 2 cts. in the second test. . . .

"The total cost of each of the rations [of herd B] was large, although the second ration was slightly less expensive than the first. Quite a number of cows in the herd were well along in the period of lactation, and were no doubt being fed too heavily for the amount of product they were giving."

The results of the previous studies on the rations of cows on dairy farms are summarized, making 38 rations in all. Of these, 29 "actually represent the feeding practice of these dairymen." The minimum, maximum, and average nutrients of these 29 rations are given below, together with feeding standards.

Rations fed by 29 Connecticut dairymen, and feeding standards.

	Organic matter.	Digestible protein.	Digestible fat.	Digestible carbohydrates.	Fuel value.	Nutritive ratio.
Rations of 29 Connecticut dairymen:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Calories.*	
Minimum	20.5	1.35	0.56	10.47	28,600	1: 4.5
Maximum	33.7	3.48	1.36	18.25	42,600	1:11.3
Average	25.5	2.36	.87	13.76	33,650	1: 6.7
Woll's average of 128 American rations	24.5	2.15	.74	13.27	31,250	1: 6.9
Ration tentatively suggested by Storrs Station	25.0	2.50	(.5 to .8)	(13 to 12)	31,000	1: 5 6
Wolff's (German) standard	24.0	2.50	.40	12.5	29,600	1: 5.4
Lehmann's (German) standards (*a*) for cows giving—						
11 lbs. of milk per day	25.0	1.60	.30	10.0	22,850	1: 6.7
16½ lbs. of milk per day	27.0	2.00	.40	11.0	25,850	1: 6.0
22 lbs. of milk per day	29.0	2.50	.50	13.0	30,950	1: 5.7
27½ lbs. of milk per day	32.0	3.30	.80	13.0	33,700	1: 4.5

a Mentzel and von Lengerke's Landw. Kalender, 1897.

In 9 of the 38 rations studied there is opportunity for comparing a wide ration with a narrower ration fed to the same herd, the narrower ration being fed from 1 to 4 weeks after the wide ration, so that the cows were somewhat further advanced in the period of lactation. The data for these 9 comparisons are summarized.

"There was an increase in milk flow in 5 cases when the animals were fed a narrow ration over that obtained with the wider ration, and in 2 other cases the yields were essentially the same in both tests, although in those instances the narrow ration was fed 4 weeks after the wide. Of the 8 herds which were fed the wide ration followed by a narrower one all except one gave an increase in butter yield during the second test. The fact that there was more often an increase in butter yield (calculated from the butter fat) than in the milk yield, during the period when the narrow rations were fed, would indicate an increase in the percentage of fat as a result of using the narrow rations. In some instances this was noticeably the case. . . . There are 6 cases where the total cost of producing 100 lbs. of milk is less with the narrower ration, and 6 cases where the cost of 1 lb. of butter is less. . . .

"Although a shrinkage in production would naturally follow from advancement in period of lactation, the herds as a whole more than held their own when changed to the narrower ration from 1 to 4 weeks after the first test. The results are in accord with observation and experiment elsewhere in that so far as physiological effects are concerned narrow (nitrogenous) rations give larger yields of both milk and butter than do wide (carbonaceous) rations."

Contribution to the rational feeding of cows, O. HAGEMANN (*Landw. Jahrb., 26 (1897), No. 4–5, pp. 555–636*).—This is a continuation of the investigations, the account of the first part of which was published about 2 years ago (E. S. R., 7, p. 237). As previously stated, the author holds that, in order to draw reliable deductions as to the relative value of feeding stuffs for cows, experiments on the digestibility and the metabolism of the food should be made.

The present investigations covered 12 periods, about a year and a half, and most of the time included 2 cows, although 5 cows were used in all. A variety of grain and concentrated feeding stuffs were studied in combination with other materials. Very complete data were secured as to the amount and composition of the food, urine, feces, and milk, and the live weight; and from these data the digestibility of the food, nitrogen and ash balances, etc., were adduced. The full data for the experiments are tabulated, and the author gives considerable space to a discussion of his method of work and of the results of the experiments. He notes the scarcity of data on the labor of digestion in cattle. This can only be determined by respiration experiments and without this the carbon balance can not be calculated. He believes it probable that rations containing large amounts of starchy material, as corn, rye, barley, with small amounts of hay and straw, require a much smaller amount of labor for digestion than rations containing hay and straw together with oil cakes rich in albuminoids.

During the corn period with cow No. 3 and one of the rye periods with cow No. 2 there was a nitrogen loss, although both cows were producing large quantities of milk, but in all other periods nitrogen was stored in the body. In these periods also there was a small loss of ash constituents. The milk production appeared to be, to a certain extent, dependent upon the feeding. It did not depend alone upon large quantities of albuminoids in the food, as is usually stated, but also on other constituents.

Cow No. 1 showed fluctuations in the milk yield which could only be accounted for by the feed. When, in the twentieth week of lactation, corn was substituted for rye as the chief grain the average daily milk yield increased 2.52 kg., or 26 per cent, and the milk contained 3.52 per cent of fat as compared with 3.26 per cent in the preceding and following periods. The corn ration contained more digestible crude protein but less albuminoids than the rye ration. In the following period when wheat bran was fed in place of the corn more crude protein was digested and the total nutrients were larger, but the daily milk yield fell off 1.51 kg. and the fat content dropped to 3.26 per cent. A mixture of rye and palm cake proved advantageous, as it nearly maintained the yield of milk and increased the fat content from 3.09 to 4.51 per cent. A ration containing poppy cake, in spite of its higher content of digestible protein and total nutrients than rations of cotton-seed meal and of peanut cake, resulted in a falling off in the daily milk yield of 1.6 kg. in 3 weeks, while on the cotton-seed-meal ration the decrease was 1.48 kg. in 4 weeks. The poppy cake is consequently less valuable than the other oil cakes.

Cow No. 2, which during 4 weeks on the peanut-cake ration shrunk 0.88 kg. in daily milk yield, shrunk only 0.31 kg. during 2 weeks on cotton-seed meal. In the following period, on poppy cake, there was a much larger shrinkage in milk and a material decrease in the percentage of fat (from 3.15 per cent on cotton-seed meal to 2.51 per cent on poppy cake). Later, after this cow had calved, a rye ration was fed, on which, in spite of only about half the amount of digestible protein, a milk yield of 15.45 kg. with 2.93 per cent of fat was maintained. The author infers from this that the milk secretion depends first of all upon the condition of the milk glands.

Cow No. 3 had received a malt-sprout ration previous to the experiment, on which she produced 10.5 kg. of milk. Four weeks later (in the seventeenth week of lactation), on a corn-meal ration, she produced 11.32 kg. of milk—an increase of 0.82 kg.—although the amount of albuminoids was relatively small (330 gm.). In the following period, in which wheat bran was fed, there was a shrinkage of 1.32 kg. in milk, although almost exactly the same amount of total nutrients and over 100 gm. more of albuminoids were contained in the daily ration.

In the experiment with cows 4 and 5 the intention was to test the effect of feeding beet molasses to both cows, but No. 4 refused to eat the molasses. A ration of barley meal and palm cake was compared with one of palm cake and molasses. On the molasses there was a shrinkage of 2.42 kg. in the daily milk yield, but an increase of 0.3 per cent in the fat content. In the following period, when the barley meal and palm cake were fed, the yield increased 1.9 kg., but the fat content diminished. The protein in the molasses ration was relatively low. The excretion of urine in this period increased from about 14 liters to

20 liters per day. The author believes it probable that continued feeding of large amounts of molasses would have an injurious effect on the heart and the kidneys.

The discussion of the mineral balance is reserved for a special article. From the results of these investigations the author draws the following conclusions:

(1) The feeding of corn is in every respect advantageous to milch cows in the production of milk and the maintenance of live weight. Following this, wheat bran, cotton-seed meal, and peanut cake range in value in the order given.

(2) Poppy cake appears to diminish the percentage of fat in the milk and to be in general inferior for milk production to the other feeding stuffs tested.

(3) Beet molasses appears to have a stimulative action on the milk glands, so that for a time more and richer milk is yielded than on rations richer in total nutrients and in albuminoids.

The cost and feeding value of the dry matter of dried corn fodder and of silage, E. B. VOORHEES and C. B. LANE (*New Jersey Stas. Bul. 122, pp. 16*).—Twelve acres of a 15-acre field of corn was cut and placed in the silo the first week in September and the remaining 3 acres were shocked in the field and carted to the barn early in October. The cost of handling the silage and the corn fodder is given. Observations were made on the amount of silage lost in the silo by molding, etc., and analyses were made of the fodder and silage at different times.

"The changes that took place in the silo resulted chiefly in a change in the proportion of fiber and nitrogren-free extract, though a slight increase was noticed in the content of ether extract. The determination of the albuminoids showed that 98 per cent of the protein in the green fodder was in the form of albuminoids, and that 95 per cent was in that form in the dried fodder at time of storage, and when the dried fodder was fed 89 per cent was in that form—that is, relatively slight changes had taken place in this compound; whereas in the silage the albuminoids constituted but 37.5 per cent of the total protein as compared with 98 per cent when put into the silo. In drying fodder, therefore, the changes due both to mechanical and chemical causes resulted in an increase of woody fiber and a decrease in protein and nitrogen-free extract, and did not seriously affect the character of the nitrogenous matter, whereas in the silo the chemical changes resulted chiefly in a small loss only of nitrogen-free extract and in a very marked change in the protein, causing a serious loss of albuminoids. These results confirm conclusions already reached, particularly concerning the loss of albuminoids in the silo."

A feeding experiment was made with 2 lots of 4 cows each to compare the silage and dry corn fodder. The lots were fed for a period of 12 days, one on the silage and the other on the corn-fodder ration, and then in a transition period of 5 days were reversed and the feeding continued for 12 days. The plan was to furnish the same amounts of dry matter in the 2 rations, one-half of this being in the form of either corn fodder or silage; but this was found to be impracticable, as the animals ate more of the silage than of the corn fodder. They ate the grain and finer parts of the corn fodder, but left the coarser parts.

The amount of nutrients consumed in each period and the yields of milk and of fat are tabulated.

Lot 1, which received corn fodder first, gave practically the same yield of milk and of fat in both periods; but lot 2, which received silage first, showed a marked falling off in yield of both milk and fat in the dried fodder period. Combining the yields of the 2 lots on silage and on dried corn fodder to neutralize any effect of advancing lactation gives the following:

Milk and fat produced and food consumed on silage and dried corn-fodder rations.

	Total yield of milk.	Average fat content of milk.	Total yield of fat.	Digestible food eaten.			
				Total dry matter.	Protein.	Fat.	Carbohydrates.
	Pounds.	*Per cent.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
On silage ration	2,276.2	3 78	86.15	1,292.8	195.2	68.5	1,029.1
On dried corn-fodder ration	2,017.9	3.86	78.02	1,210.8	191.1	62.7	957.0
Gain from silage	258.3	—0.08	8.13	....	....	....	....

"It will be observed that, although the total amount of dry matter furnished by each ration was practically identical, the yield of milk from the silage ration is 258.3 lbs., or 12.8 per cent, greater than that from the dried fodder ration for the same cows for a like period; and the yield of butter fat is 8.13 lbs. greater, or 10.4 per cent."

About 6.8 per cent more dry matter was consumed on the silage rations than on the dried fodder rations. The animals gained about 200 lbs. on the silage. The results of the experiments are summarized as follows:

"(1) The cost of harvesting, storing, and preparing the dry matter contained in corn was greater in the form of silage than in the form of dried fodder.

"(2) The changes that occur in the composition of silage were not such as to decrease its feeding value in a greater degree than those which occur in the process of curing corn fodder; and the losses due to spoiling in the silo amounted to 4 per cent of the total amount stored.

"(3) For milk and butter production the feeding value of the dry matter of the silage was greater than that of the dried fodder corn. The yield of milk was 12.8 per cent greater and the yield of fat 10.4 per cent greater."

On the basis of these experiments it is estimated that about $10 per acre more would be realized for corn fodder when preserved and fed in the form of silage than as dried fodder.

Further experiments in cream ripening—flavor, aroma, acid, H. W. Conn (*Connecticut Storrs Sta. Rpt. 1896, pp. 17–43*).—As showing the variation in the number and character of the bacteria at different times a series of experiments with 8 cows are reported in which the milk of each cow was examined for bacteria at different intervals. There was found to be a great difference in the number of bacteria from different cows at the same time and also great variety in the bacterial flora at different times. No 2 of the samples from the first testing underwent the same kind of fermentation; and when the milk was tested later there was a noticeable change in this respect. Mention is also made of the variations in the bacteria found at the same creamery at different times.

The main part of the article is devoted to the results of experiments with 68 species of bacteria. These were all distinctly dairy bacteria, some being collected directly from cream at creameries, others from milk, others from the dust which fell from the cow during milking, etc. All of the general types of milk bacteria were included in the list. The experiments were with pasteurized cream. In each series of experiments one lot of the cream was ripened with the bacteria in question and another lot was left without any starter. No technical descriptions are given of the different species, but brief statements are given regarding the origin of each species and its effect upon the cream and the butter. The results are classified and discussed at considerable length.

"The majority of the species tested may be regarded as indifferent in their effect upon the butter. About half of them, when used to ripen the cream, as will be seen in the experiments described below, produced butter that had neither flavor nor aroma nor acid, and the butter was practically indistinguishable from the control butter. These species are the largest in number and are present in the greatest variety around barns and dairies. . . .

"A considerable portion of the species found are positively favorable in their influence upon the butter. Of the 68 species tested, 20 produced butter that has been described in our notes as good flavored. . . .

"Of the 20 above mentioned, 9 were lactic organisms. On the other hand, 11 were among the class which would be described as alkaline species, by which it is meant that they either produced an alkaline reaction in the milk or produced no change in its reaction. They are at all events distinctly not acid forms. Seven among them liquefy gelatin and are, therefore, among what are called the putrefactive bacteria. . . .

"A smaller number of species produced injurious effects upon the butter; 18 species among the 68 tested have been described as producing butter that was bad, or poor, or strong flavored, or disagreeable; various adjectives being used to indicate the different effects. Sometimes the poor flavor was a putrefactive taste; in other cases it was a bitter taste; in others, again, a strong sour taste; while in still others the effect was of a peculiar indescribable character. In many of these 18 species the unpleasant flavor was very slight, and probably insufficient to materially injure the butter. . . .

"Of the 18 species described as producing injurious effects upon the flavor of the butter, 9 belonged to the acid-producing class, while 9 belonged to the class developing alkaline reaction.

"From these facts it appears to me a safe and perfectly legitimate inference that flavor is a matter entirely distinct from acid. It will be noticed that among the acid-producing species there are some that develop good flavor, while others develop a decidedly unpleasant flavor; and it will be noticed that among the species producing good flavors in the butter, while many of them are acid producers, a large number, 11 out of 20, are among those that develop no acid. . . .

"While, therefore, the lactic bacteria may be regarded as commonly producing the butter flavor in practical butter making, they do not do this simply because they produce acid, and we must recognize that other types of bacteria probably assist in producing the desired flavor. It is important to note in this connection that of the 30 species described as indifferent in their action, none were acid organisms.

"Perhaps the most interesting result has to do with the production of the butter aroma. The butter aroma, the character that affects the nose rather than the palate, appears to be, at least so far as the results of the experiments are concerned, entirely independent of the flavor. Moreover, it appears to be a more unusual thing for bacteria to produce a desirable aroma than a desirable flavor. The great majority of these species tested give rise to practically none, or at least to an extremely slight aroma. Thirty-nine produce no aroma at all, [and] the majority, again, are among the class which either develop an alkaline reaction in the cream or do not change its reaction at all. Seven of those producing no aroma are among the class that produce lactic acid. Among those that do produce an aroma of a decided character, 18 are described in my laboratory notes as producing an unpleasant or a bad aroma; 7 of these are among those that produce lactic acid. . . . Only 8 have been found as yet to produce an aroma which has been described in my notes as good; and in only 3 has the aroma been that which is looked for in first-class butter. In 2 or 3 cases the aroma produced was of an extremely fine character, and in these artificial tests almost identical with the aroma expected in the first-class butter from a creamery. It has been interesting to find that, of the 8 species which produce the aroma which has been described as good, none has been among the acid-producing organisms. The 8 either develop an alkaline reaction or have no special effect upon the reaction of milk. There were 3 which developed the most typical aroma of all the species studied. Two of these curdled milk by producing a rennet, both liquefying gelatin. The third did not curdle the milk. This result has been a surprise to me, inasmuch as I had supposed before the experiments began that the aroma was a matter very closely associated with the development of the lactic acid. . . .

"It has been found in these experiments thus far that none of the species tested combines all of the 3 characters—the power of producing flavor, acid, and aroma. Some develop flavor with the acid, others develop aroma with flavor, and others develop aroma without any special flavor. As yet no single species has been discovered that produces all simultaneously. This result is not, of course, surprising, for, recognizing that the ripening of cream must be an extremely complicated process, and produced by a large number of species of bacteria working together, it is a natural inference that the different qualities in the butter may be caused by different species of bacteria. It is by no means to be implied, however, that the 3 properties may not be combined in some species of bacteria."

In conclusion, it is noted that some of the species of bacteria producing good flavor in the butter were quite widely distributed during the month of June. One species in particular which gave a good flavor and a strong acid was found during the months of May and June in each of the creameries from which cream was taken. This is suggested as a possible explanation of the generally high quality of butter made during these months.

Bacillus acidi lactici and other acid organisms found in American dairies, W. E. ESTEN (*Connecticut Storrs Sta. Rpt. 1896, pp. 44–52*).—This is the result of a study of the occurrence of these organisms in milk from different sections of the country. Samples of milk were collected within a wide extent of territory, including the New England States, New York, Pennsylvania, and Ohio. Fifty-three samples of milk were obtained from 30 different dairies. From these, 111 colonies were isolated, 34 of which were discarded as not producing acid or as being nearly anærobic; and of the 77 remaining 47 appeared to be the same species—*Bacillus acidi lactici.*

The history of early work on this organism, technique of experiments and analysis of the principal organism, and the physiological and morphological characters of *Bacillus acidi lactici* as found in milk in the United States are discussed at considerable length.

As to the habitat of this organism, experiments were made with hay and hay dust and with milk direct from the cows. No organisms resembling *Bacillus acidi lactici* were propagated from hay or hay dust, but the experiments with milk direct from the cow "suggest the possibility that *Bacillus acidi lactici* comes from the cow in the milk duct, since its maximum temperature of growth is about that of the body temperature."

Three species of organisms were found which resembled *Bacillus acidi lactici* so closely that the author considers them varieties of that organism. The first differed from it by not growing at 35° C., and by rendering milk strongly acid without curdling it; the second was almost identical with the first, except that it rendered milk only slightly acid; while the third was like the second, but grew at 37.5° C. Many of the samples of milk yielded a nearly pure culture of *Bacillus acidi lactici.*

"It is necessary to repeat more fully the experiments in the territory covered and to obtain data from other places before a valuable scientific conclusion can be drawn. It is of course possible that the 47 organisms isolated are a collection of many species, but the evidence from the data obtained leaves no doubt in my mind that they are the same species.

"Milk from 30 widely separated localities in New York, Pennsylvania, Ohio, Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut yielded, with 2 exceptions, apparently the same organism. This fact throws the weight of evidence on the side of the belief that one organism universally exists in the territory studied, which produces the ordinary souring and curdling of milk. This organism seems to be identical in every particular with that of Günther and Thierfelder, who concluded that their organism was the same as Lister's *Bacterium lactis* and Hueppe's *Bacillus acidi lactici.*"

A new milk preservative, A. W. STOKES (*Analyst, 22 (1897), Dec., pp. 320, 321*).—The "Rhodian purifier," which it was claimed would keep milk sweet for several days, in the warmest weather, was found to consist of potassium nitrate and water, there being 19 per cent of the nitrate. It had no merits as a preservative. Its presence in milk is detected when the milk solids are incinerated by deflagration, and the ash if taken up in dilute sulphate gives the nitrate reactions. In testing milk by the Gerber, Leffman-Beam, or Babcock processes a yellow color appears when the milk containing this preservative is mixed with strong sulphuric acid and minute bubbles of nitrous gas are given off.

A new milk adulterant, A. W. STOKES (*Analyst, 22 (1897), Dec., pp. 321, 322*).—A "secret nostrum for concealing the addition of water to milk" was found to contain 1.96 per cent of dextrin. It was claimed that 20 per cent of water could be added to milk without fear of detection, provided 4 oz. of the material was added per pint of milk. It was said to be used extensively in Australia. It could be detected by the small amount of unaltered starch it contained, which gave the iodin reaction.

The dairy herd: Its formation and management, H. E. ALVORD (*U. S. Dept. Agr., Farmers' Bul. 55, pp. 24*).—This is a reprint with revisions from the Yearbook of this Department for 1894 (E. S. R., 7, p. 523).

The development of dairying in Southwestern France (*Milch Ztg., 26 (1897), No. 51, pp. 811–813*).

Comparative studies on the milk production of Swiss and native goats, W. WINTROP (*Milch Ztg., 26 (1897), No. 50, pp. 795, 796*).—A record for 13 Swiss and 10 native goats, covering several months, showing the average yields at each of the 3 milkings daily.

Does the direct transmission of fat of the food to the milk take place? H. WINTERNITZ (*Deut. Med. Wchnschr., 23 (1897), p. 477; abs. in Chem. Ztg., 21 (1897), No. 73, Repert., p. 200*).—The author made experiments in feeding animals pork fat to which iodin had been added. Finding iodin in the milk fat, he concludes that a direct transmission of the fat of the food to the milk may take place.

The sesame oil reaction in natural butter, A. SCHEIBE (*Milch Ztg., 26 (1897), No. 47, pp. 745, 746*).—A cow was fed 2 kg. (4.4 lbs.) of sesame cake per day. At the end of a week the butter made from the milk gave a weak but distinct reaction for sesame oil, and this continued with further feeding. Although the reaction was not as strong as in butter to which margarin containing sesame oil had been added, the author thinks it invalidates the sesame oil reaction as a test for margarin.

Experiments in milking at different times, H. HUCHO (*Milch Ztg., 26 (1897), No. 44, pp. 695–697*).—An account of experiments in milking sheep and a goat once, twice, and three times daily.

The infection of milk by microbes, M. E. CASTEL (*Dairymen's Assoc. Prov. Quebec, Rpt. 1896, pp. 216–233, figs. 17*).—A lecture illustrated by magic-lantern slides. Incidentally the results of some experiments on the infection of milk from the foremilk, the cow and the milk, unclean vessels, and barn air are popularly described.

Ripening cream with kephir, B. MARTINY (*Milch Ztg., 26 (1897), No. 48, p. 766*).—The author reports a trial on a small scale of ripening cream with a culture of kephir in milk. The butter was pronounced of good flavor and kept well for the short time under observation. The buttermilk was much improved in flavor over ordinary buttermilk. The author urges experiment stations to continue the study.

Preservation of milk by partial freezing (*Milch Ztg., 26 (1897), No 50, pp. 796, 797, figs. 2*).—This is very similar to an article recently noted (E. S. R., 9, p. 581) on the partial freezing of milk for transportation.

Milk standard of St. Petersburg (*Chem. Ztg., 21 (1897), No. 101, p. 1058*).—To determine a proper normal the municipal laboratory examined 2,830 samples of milk. On the basis of this work it concludes that good milk should not contain less than 4 per cent of fat and 13 per cent of solids; and that milk offered for sale in the city containing less than 3 per cent of fat and 12 per cent of solids will be held unsatisfactory. Milk intended for hospitals, schools, etc., must fulfill all the requirements as to purity, freshness, taste, odor, consistency, and nutritive value.

Concerning the exactness of the determination of fat in cream by centrifugal testers, H. SCHROTT-FIECHTL (*Milch Ztg., 26 (1897), No. 52, p. 830*).—Diluting the cream with water or skim milk of known composition was found unsatisfactory with different tests. The cream-testing bottle with the Babcock test gave results which compared as favorably with the gravimetric results as are obtained in the case of milk.

Butter making on the farm, C. P. GOODRICH (*U. S. Dept. Agr., Farmers' Bul. 57, pp. 15*).—This a popular bulletin on farm dairying, treating of the care and handling of milk, cream raising by deep setting and by separator, ripening cream, churning, mottles or "white specks" in butter, coloring butter, salting and working, and making butter to suit the customer.

With reference to the thoroughness of creaming, the author gives the results of tests of skim milk brought by farmers to farmers' institutes in the State of Wisconsin.

"For 2 years the writer preserved the report of these tests, and the average of all was 0.8 for the skim milk creamed by any gravity method. It varied from 0.25 per cent to 1.6 per cent. This was in the winter, when there was no difficulty in having the milk cold enough. There is no doubt that in summer, during hot weather, the average loss is still greater. If the separating is done on the farm immediately after the milking, the skim milk from the separator seldom tests more than 0.1 per cent, and frequently less than that.

"From the result of these tests it seems impossible to escape the conclusion that the average loss, where the milk is set in pans, cans, and crocks, is $\frac{3}{4}$ of a pound of butter more to each 100 lbs. of milk than where the separator is used. This means, with milk of average richness (3.5 per cent butter fat), a loss of about 20 per cent of the total product of butter. A herd of cows ought to average, per cow, 5,000 lbs. of milk per year, and would do so if made up of good animals and well managed; but even if they only average 3,000, the loss on one cow would be 22½ lbs. of butter and on 10 cows 225 lbs., which, at 20 cts. per lb., would be $45 a year."

On butter aroma, H. WEIGMANN (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 19–20, pp. 497–504*).—This is a controversial article in which the author discusses the origin of the aroma of butter under normal conditions, and takes exception to the value of organisms isolated especially for their aroma-producing qualities, since such organisms easily lose their specific action under those conditions.

Home-made fancy cheese, G. E. W. (*Sci. Amer., 78 (1898), No. 4, p. 54*).—Popular directions for making Roquefort, Stilton, Gorgonzola, and Gérome or Gérardmer cheese.

Notes on cheese making from sheep's milk in Transylvania, P. THIELE (*Milch Ztg., 26 (1897), No. 46, pp. 727–729, fig. 1*).—Directions are given for making 3 kinds of cheese.

On the Thistle milking machine, SCHÜTT and AHRENS (*Milch Ztg., 26 (1897), No. 44, pp. 702, 703*).

Wahlin's patent butter accumulator (*Milch Ztg., 26 (1897), No. 51, pp. 813, 814, figs. 2*).—An illustrated description of this English butter extractor.

The Radiator, a new separator and churn, B. MARTINY (*Milch Ztg., 26 (1897), No. 50, pp. 791, 792*).

Experiments with the Radiator, B. MARTINY (*Milch Ztg., 26 (1897), No. 52, pp. 823, 824, figs. 2*).—A brief résumé of some experiments with this apparatus in France, Sweden, and Germany.

AGRICULTURAL ENGINEERING.

Windmills for irrigation, E. C. MURPHY (*Water Supply and Irrig. Papers, U. S. Geol. Survey, No. 8, pp. 49, pls. 8, figs. 30*).—This is a condensed report of results of experimental tests carried on during the summer of 1896 upon windmills located for the greater part in the vicinity of Garden, Kansas.

"The pumping power of windmills, or the useful work they do when raising water with reciprocating pumps of sizes from 4 to 10 in. diameter, is small—not greater than 0.65 of 1 horsepower for 12-foot mills, and much less than that claimed for them by some windmill makers. . . .

"Perhaps the most important result shown by these tests, and one that has not been clearly shown before, as far as the writer has seen, is the influence of load on mill, or a number of foot-pounds per stroke of pump on the power of a mill. . . . The tests show that for high velocities—20 or 30 miles—the power is very nearly proportional to the load on the mill. For 30 miles per hour, a brake load of 2 lbs. gave 0.54 horsepower; a 4-pound load, 1.09 horsepower; and a 6-pound load, 1.55 horsepower. . . .

"Another fact brought out by these tests, and which follows as a result of the previous ones, is that there should be some automatic device for increasing the load on a mill as the wind velocity increases. When the velocity is low—say 6 miles per hour—the load should be small enough to enable the wind wheel to run at a rapid rate—the rate for maximum power—and then as the wind velocity increases the load should be increased so as not to allow the wheel to run at a higher speed. This is a very promising field for the inventor.

"If the load can not be automatically increased as the wind velocity increases, then the question arises, What is the proper or most economical load? This depends on the velocity of the wind each month at the given place. During the months of July and August there are a greater number of hours of low wind velocity than during any other 2 months of the year. The load should be light during these months for the greatest power. . . .

"The useful work that a windmill will do when working under a constant load at all velocities is small, the horsepower varying as the first power of the velocity. By some device for automatically increasing the load as the wind velocity increases, the power may be much increased at high velocities, and will then vary as the second power of the velocity. Even with this device for increasing power there is still a great difference between the power possessed by the wind and the power developed by the mill, and this difference increases as the velocity increases."

An experiment with a steam drill, C. H. PETTEE (*New Hampshire Sta. Bul. 46, pp. 59–76, pls. 7*).—An account is given of the improvement of a street in the town of Durham commanding the approaches to the college. In carrying out this work it was necessary to reduce a hill 510 ft. in length to a uniform grade (1 in 20 and 1 in 22), to make several fills, and to remove the masses of rock which encroached upon the roadway and forced it to one side. For the latter purpose a portable steam drill capable of drilling 4 to 5 ft. per hour was used.

Tables give the cost of equipment, blasting rock, and handling material, from which it appears the cost of handling rock, including the work with the drill, was $1.11 per cubic yard and was greater than that of the earth fill.

"There is need, however, of a large amount of rock work upon the average country road. The steam drill is absolutely essential for the economical handling of considerable rock masses, and is capable of doing exceedingly economical work, in portable form, for small amounts of work in a place."

The comparative cost of moving different road materials and the question of a standard grade are briefly discussed.

A practical study of road maintenance, C. H. PETTEE (*New Hampshire Sta. Bul. 46, pp. 77–88*).—This is a report of a critical study of the work of the highway agents of the town of Durham during the year ending in March, 1897, and includes comments on the keeping of accounts and general management, road surfacing, road machines, highway laws, and public opinion on highway maintenance.

Irrigation practice on the Great Plains, E. B. COWGILL (*Water Supply and Irrig. Papers, U. S. Geol. Survey, No. 5, pp. 39, pls. 12, figs. 8*).—This paper gives the experience of a practical farmer and irrigator with methods of utilizing the water resources of semi-arid areas, and is devoted to the following topics: Reservoirs for storm waters, reservoirs for pumped water, ditches, distributing water, methods of watering, cultivation, subirrigation, amount of water required, and winter irrigation.

Irrigation in Connecticut, C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1896, pp. 216–245, figs. 2*).—The main features of this article will be found in U. S. Dept. Agr., Office of Experiment Stations Bul. 36, pp. 9–26 (E. S. R., 9, p. 97).

Seepage water of Northern Utah, S. FORTIER (*Water Supply and Irrig. Papers, U. S. Geol. Survey, No. 7, pp. 50, pls. 3, figs. 13*).—"The facts herein presented are based upon field work carried on mainly during the summer of 1896, and have special value in illustrating conditions which prevail to a greater or less degree throughout all irrigated lands, especially within inclosed valleys or on long, narrow drainage systems." Many of the data here reported are also given in Bulletin No. 50 of the Utah Station (E. S. R., 9, p. 427).

Report of the engineer, O. V. P. STOUT (*Nebraska State Bd Agr. Rpt. 1896, pp. 95–104*).—This is a report of measurements under the direction of the Nebraska State Board of Irrigation of the rate of discharge during the growing season of 1896 of the following Nebraska streams: Frenchman River at Palisade, Republican at Superior, North Platte at Camp Clarke, North Platte at North Platte, Platte at Columbus, Middle Loup at St. Paul, North Loup at St. Paul, Loup at Columbus, Elkhorn at Norfolk. Besides these regular observations, a table of measurements of discharge at other points than the gaging stations is given.

Digest of the general and special road laws of Pennsylvania, A. D. HARLAN (*Pennsylvania Dept. Agr. Bul. 18, pp. 129*).—This is a digest "of all of the General Laws of Pennsylvania, referring to roads, highways, and bridges, up to and including the session of 1895. Also an index to road, highway, and bridge laws as they affect municipal corporations, including cities of the first, second, third, fourth, and fifth classes, together with an index to all special county and township road laws."

Cheap silos in Virginia, D. O. NOURSE (*Virginia Sta. Bul. 70, pp. 115–119*).—A brief account is given of the successful use of cheap silos at the station, especially of a stave silo, the cost and details of construction of which are given. A table which shows the capacity of round silos of different sizes is added.

STATISTICS—MISCELLANEOUS.

Reports of executive committee, treasurer, and director of Connecticut Storrs Station, 1896 (*Connecticut Storrs Sta. Rpt. 1896, pp. 3–16*).—Includes lists of the trustees and officers of the station; report of the treasurer for the fiscal year ending June 30, 1896; a brief report by the executive committee on the general conduct of the station; and a report by the director, reviewing in detail the work of each department of the station for the year.

Seventh Annual Report of North Dakota Station, 1896 (*North Dakota Sta. Rpt. 1896, pp. 51*).—This contains the organization list of the station; reports by the chemist, veterinarian, horticulturist, botanist, and agriculturist, and of the departments of dairying and domestic science, parts of which are noted elsewhere; and a financial statement for the fiscal year ending June 30, 1896.

Ninth Annual Report of South Carolina Station, 1896 (*South Carolina Sta. Rpt. 1896, pp. 32–48*).—Brief reports are given by the director and heads of departments on the work of the year, parts of which appear elsewhere, and a financial statement for the fiscal year ending June 30, 1896.

Annual Report of South Dakota Station, 1897 (*South Dakota Sta. Rpt. 1897, pp. 5*).—Brief remarks by the director on the publications and the general conduct of the station during the year with a review of the work accomplished in each of the departments, and a financial statement for the fiscal year ending June 30, 1897.

Annual Report of Virginia Station, 1896 (*Virginia Sta. Rpt. 1896, pp. 13*).—Brief reports by the director and heads of departments on the work of the year, with list of bulletins published, and a financial statement for the fiscal year ending June 30, 1896. Some meteorological data included within these pages is noted elsewhere (see p. 731).

Reports of director and treasurer of West Virginia Station, 1891 (*West Virginia Sta. Rpt. 1891, pp. 4–20*).—The texts of the Hatch Act of March 2, 1887, of the State act accepting appropriations from the United States Government for the establishment and maintenance of an agricultural experiment station, and of State legislation relative to commercial fertilizer inspection are given, together with remarks on the plan of the station organization and work, and a financial statement for the fiscal year ending June 30, 1891.

Ontario agricultural statistics, 1896 (*Ontario Bureau Ind. Rpt. 1896, pp. 1–155*).—This gives the acreage and classification of the assessed farm lands of each of the counties of Ontario in 1895 and 1896; acreage under pasture for the 5 years ending 1896; acreage under crops for each of the years 1892 to 1896, and the average for the 15 years 1882 to 1896; yield in bushels of the different farm crops for 1895 and 1896 and the average yield for the 15 years ending with 1896; extracts from remarks of correspondents on crop and live stock conditions during 1896; data showing the acreage in gardens, vineyards, and orchards and the number of trees of bearing age, and the yield of apples in 1895 and 1896; statistics on the weather noted elsewhere (see p. 731); live stock, dairy, and apiary statistics, with the name and post-office address of the secretary of each cheese factory in the Province; value of farm property, live stock, and farm crops for each of the 15 years 1882 to 1896; and the rate of wages paid farm laborers by the year and by the month with and without board for each of the years 1892 to 1896 and the average for the 15 years ending with 1896.

There is an almost regular decrease in the value of farm lands for the past 14 years, the decrease in 1896 being $15,470,202 over the preceding year, and $97,324,745 over the year 1883; the total value of all farm property, including buildings, implements, and live stock has also decreased since 1883, being more than $51,000,000 less than at that time. The rate of wages paid farm laborers in general shows a constant decline, each year's average being less than the previous year and less than the average for the preceding 15 years.

Farm statistics of Michigan, 1896–'97 (*Rpt. Sec. State Michigan, 1896–97, pp. XLIX, 123*).—This gives the acreage and yield of farm and orchard crops, and the number and kinds of farm animals in the State in 1897, together with the number of sheep and the wool production of 1896.

Agricultural improvements at the Meerut demonstration farm in 1896 (*Agr. Ledger (Agr. ser., No. 17), 1896, No. 18, pp. 5*).

Report of the superintendent of farmers' institutes of the Province of Ontario 1896–'97, F. W. HODSON (*pp. XL, App. pp. 240*).—A review of the work of the year with lists of officers, meetings, speakers, subjects, etc.; data showing membership of local farmers' institutes, meetings held, attendance, cash receipts and expenditures, etc.; and an appendix containing reprints of 93 selected papers read at different institutes during the season. The summarized statement of the author shows that 3,277 addresses on agricultural topics were delivered during the year, and that 659 meetings were held, with a total attendance of 125,127 persons.

Dates and places of farmers' institutes in Pennsylvania for the season of 1897–'98 (*Pennsylvania Dept. Agr. Bul. 25, pp. 8*).

Experiment station work—I (*U. S. Dept. Agr. Farmers' Bul. 56, pp. 31*).—This is the first of a series of brief popular bulletins based upon the work of the agricultural experiment stations, the object of which is to show some features of the progress of agricultural investigation on its practical side. The following topics are briefly treated: Good *vs.* poor cows, corn *vs.* wheat, effect of rations richer and poorer in protein, forage crops for pigs, Robertson silage mixture, alfalfa, effect of fertilizers on the proportion of grain to straw or stover, comparative fertilizing value of different phosphates, the harmful effects on soils of the continued use of muriate of potash, recent progress in the study of irrigation, potato scab, and barnyard manure.

NOTES.

Iowa Station.—The experiments conducted last year to determine the cost of production and value of the product from the various breeds of hogs, including the English bacon breeds, together with a final test on the foreign market and a chemical analysis of representatives of each by the United States Department of Agriculture, are being repeated. The range lamb feeding experiment reported last year in Bulletin 35 is being repeated this winter; and a carload of range-bred calves, including 6 each of high-grade Herefords, Angus, and Shorthorns, are under investigation to determine the economy of feeding that class of stock in the corn-belt agricultural States. The dairy herd of about 40 cows, containing good representatives of 4 pure breeds, has been under careful study and investigation with reference to determining the cost of production from the several types and breeds during the past year, and exceedingly interesting and valuable results have been obtained. This work will be continued indefinitely and a summary of results published at the end of the second or third year, supplemented by other reports later.

Missouri College and Station.—The special committee appointed by the State Board of Agriculture to examine the Missouri Agricultural College and Experiment Station has issued a very favorable report, showing an excellent condition of all work at Columbia.

Rhode Island Station.—A. A. Brigham, professor of agriculture in the college, has been made director of the station.

Texas Station.—The station has resumed the publication of press notes, discontinued for two years. In revising its mailing list the station has classified its publications under the 3 heads, "General farm crops," "Fruits and vegetables," and "Stock husbandry," and has requested that those on the mailing list indicate which class or classes of bulletins they are especially interested in. The result is quite satisfactory and will effect a considerable saving in the cost of bulletins. Many write that they do not care for more than one or two classes of reports. About 1 in 4 want them all.

Personal Mention.—Dr. G. Krause, of Halle, has been tendered the professorship of botany at Würzburg, held by the lately deceased Julius Sachs.

In consequence of the gift by F. Kempe of 150,000 crowns there has been established a professorship of plant biology in the University of Upsala, and Dr. Lundstrum has been chosen as the first occupant of the new professorship.

Dr. Manly Miles died February 16, 1898, at Lansing, Michigan. Dr. Miles was associated with agricultural education and experimentation for many years, and was the author of several books on agricultural topics, notably one on stock breeding.

Charles Ernest Cornevin, professor of zootechny and general hygiene in the National Veterinary School of Lyons, France, and in the School of Practical Agriculture of the Rhone, died November 24, 1897, at the age of 51 years. He was the author of an excellent treatise on zootechny and has made extended studies on poisonous feeding stuffs and on the use of the industrial by-products in the feeding of animals, including, among others, experiments with Cytisus, potatoes, and castor-bean and cotton-seed cakes. The results of these studies are embodied in two books, entitled *Les plantes vénéneuses considérées au point de vue de l'empoisonnement des animaux de la ferme* and *Des résidus industriels dans l'alimentation du bétail.* He also made valuable contributions to the knowledge of animal diseases. He investigated hog cholera and gangrenous septicæmia, and in connection with Arloing and Thomas showed the distinction between symptomatic charbon of cattle and charbonous fever, proposing a successful method of vaccination against the former.

EXPERIMENT STATION RECORD.

VOL. IX. NO. 9.

The completion during the current college year of a large and well-arranged building for the special use of the College of Agriculture of the Ohio State University is a notable event indicating the progress of higher education in agriculture in this country. Nothing in our educational history in recent years is more striking than the rapid increase in resources and students of the colleges and universities deriving their support mainly or entirely from the State and national treasuries. And it is very encouraging to the friends of agricultural education to observe that the facilities for technical training in agriculture are being increased in many of these institutions in a measure commensurate with the importance of the interests involved in such training. The employment of better trained teachers, the division of instruction in the complex subjects embraced in the science and practice of agriculture along the lines of well-defined specialties, the provision of adequate buildings and equipment, and the organization of courses of instruction to meet the needs of different classes of students mark the development of education in agriculture in ways which advancing pedagogical science has shown to be essential to success in modern educational systems. Already experience has shown that the proper organization and equipment of courses in agriculture on a broad and dignified plan which puts them on an equality with the other courses offered in a university is the surest way to attract and hold students and to enable the institution to exert its rightful influence in promoting the progress of agriculture in the region to which it especially ministers. The success of the Ohio State University in its agricultural work within the past few years has been marked, and the erection of the new building is taken as a convincing proof that the university will continue to strengthen and develop its work in this direction. Both instructors and students will naturally labor with renewed earnestness and enthusiasm in an environment which assures them that agriculture is recognized as of equal importance with other subjects in the estimation of the university authorities. We have deemed this event of sufficient interest and importance to warrant us in in giving here a brief description of the building, accompanied by some illustrations.

The building has been named Townshend Hall, after the late Dr. N. S. Townshend, "as a memorial of his public services and his work in advancing the cause of agricultural education." The exterior appearance of the building is shown in the accompanying illustration (fig. 7). It is 260 feet in length, and varies in width from 64 to 78 feet. It is of slow-burning construction and cost about $70,000. It contains a basement and two main floors. Plans of the basement and first floor are shown (fig. 8).

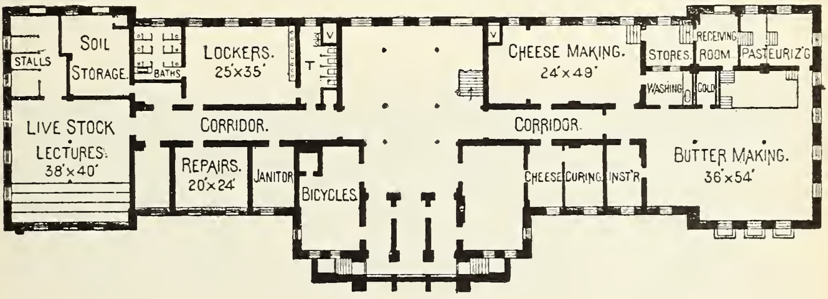
The basement, which is 15 feet high, is entirely above ground on the rear of the building, and is amply lighted from all sides. At one

FIG. 7.—Townshend Hall, Ohio State University.

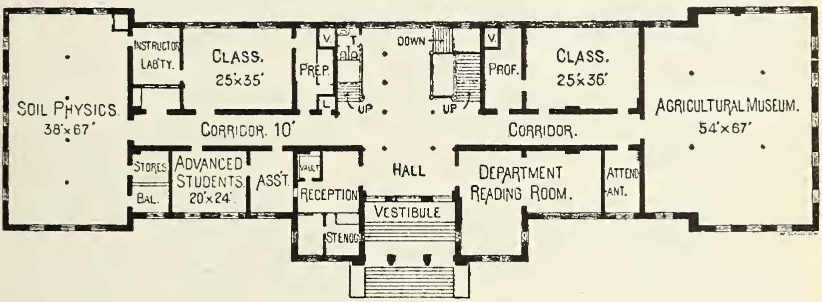
end is located the dairy department, with rooms for testing and pasteurizing milk and for butter and cheese making (fig. 9). An adjoining building, 16 by 30 feet, contains the boiler and engine for the use of this department. At the opposite end of the basement are accommodations for live stock, while lecturing upon or judging them. Adjacent to, but detached from, the soil storage room is a glass house, 30 by 40 feet, for the experimental study of soils and farm crops.

The first floor contains the offices, class rooms, laboratories, reading room, library, and museum of the department of agriculture. The museum will contain not merely specimens of farm products and samples of agricultural implements, but an attempt will be made to show the development of both Ohio and American agriculture and the industries intimately connected with it.

The second floor contains the office, library, laboratories, and class room of the department of agricultural chemistry. The main laboratory, located over the agricultural museum, is 65 by 75 feet, and will accommodate 100 students at a time. The lecture room, at the opposite end, will seat 160 persons. Adjacent to this is a suite of rooms for the department of veterinary medicine. An assembly hall for the Townsend Society, located in the center of the front over the entrance hall, will seat about 200 persons. Connected with this hall is an office for the editors of *The Agricultural Student.*



Basement.



First story.

FIG. 8.—Townshend Hall, Ohio State University. Plan of basement and first story.

As the result of the report on the agricultural capabilities of Alaska, made by the agents of this Office at the close of last year, Congress has continued and increased the appropriation for investigations in Alaska with reference to the establishment of agricultural experiment stations there. Prof. C. C. Georgeson, formerly professor of agriculture in the Kansas Agricultural College, has been assigned to this Office as special agent in charge of the Alaska investigations. He will make his headquarters at Sitka, and will institute experiments with cereals, vegetables, and other crops at a number of places in that vicinity. He will also visit Kadiak Island, Cook Inlet, and other points north of Sitka with reference to the selection of land for experimental purposes and the institution of experiments with the cooperation of residents of

Alaska interested in the development of its agriculture. Questions relating to the temperature, moisture, and drainage of the soil, the curing and storage of forage plants, and the shelter and care of animals will receive early attention.

The Weather Bureau of this Department will also establish a special climatological service in Alaska the present season. A meteorological station will be located at Sitka and instruments will be furnished to voluntary observers in different parts of Alaska. In this way observations will be regularly made, which it is hoped will be of much service in the solution of agricultural problems, as well as of great importance to other interests in Alaska.

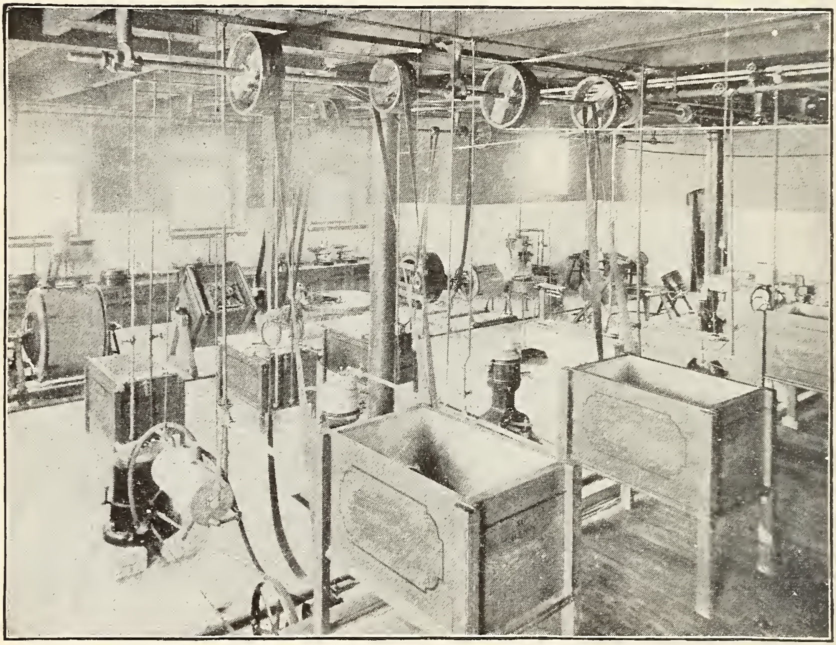


FIG. 9.—Townshend Hall, Ohio State University. Butter-making room.

The Geological Survey of the Department of the Interior has sent out parties to examine and map portions of Alaska hitherto almost or entirely unexplored. One party will survey the region adjacent to the 141st meridian, while others will explore the drainage basins of the White and Tanana rivers, the Kuskokwim River, and the Sushitna River. The several parties are expected to rendezvous at St. Michaels in September. In addition to these parties the War Department will send an expedition to explore the Copper River region. Two geologists will accompany this expedition.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

Report of the chemical control station at Christiania, Norway, 1896, F. H. WERENSKIOLD (*Aarsber. Offent. Foranst. Landbr. Fremme, 1896, pp. 117–169*).—Of the more important data given in the report, mention is here made of the following:

Alkaloids in cotton-seed meal.—The author, in following the scheme of analysis outlined by Dragendorff, separated the chlorin compounds of 3 alkaloids, (1) by shaking the acid extract with chloroform, (2) by shaking the alkaline extract with chloroform, and (3) by digesting with chloroform the extract evaporated on pumice stone.

The compound separated by the second method proved to be cholin that by the third, betain; and that by the first, a new, perhaps unknown, alkaloid, at any rate one hitherto not identified in cotton-seed meal· The 3 alkaloids gave the same reactions with iodin-potassium iodid, phosphomolybdic acid, phosphowolframic acid, picric acid, tannin, corrosive sublimate, potassium-bismuth iodid, potassium-cadmium iodid, and potassium-mercury iodid. But they gave quite different reactions with gold chlorid and platinum chlorid. Platinum chlorid dissolved in water gave no precipitate with 1 and 2, but a yellow precipitate with 3; platinum chlorid dissolved in alcohol gave no precipitate with 1 and 2, but a yellow crystalline precipitate with 3. Gold chlorid dissolved in water gave no precipitate in case of 1 and 2, but a yellow crystalline and difficultly soluble precipitate with 3. No. 1 crystallized by slow evaporation partly in octahedra or similar crystals, partly in feathery aggregates. The author proposes the name of gossypein for this alkaloid.

Macroscopic impurities in milk.—The author examined 64 samples of whole milk, skim milk, and cream for macroscopic impurities, and obtained the following average results:

Impurities in milk and cream.

	Number of samples.	Macroscopic impurities.	
		Average.	Range.
		Mg. per liter.	*Mg. per liter.*
Whole milk	36	2.6	0.1–4.1
Gravity skim milk	12	2.1	1.0–4.2
Centrifugal skim milk	3	.3	.0–0.9
Cream	3	1.5	.8–2.0

The impurities were largely particles of litter and fodder, although particles of dung and fibers of straining cloths, etc., were found in nearly all samples. Woolen and colored cotton fibers from the clothes of attendants were found in nearly half the samples. For the sake of comparison, some other food articles were examined in the same manner, with results as follows: Granulated sugar, 65.3 mg. impurities per kilogram; "tea sugar" (fine granulated), 242.5 mg.; kitchen salt, 366 mg.

Composition of Norwegian root crops.—The investigation of Norwegian root crops, begun in 1893, was continued, and 67 samples of different kinds of roots analyzed. The average results of the analyses are shown below:

Composition and yield of Norwegian root crops.

	Water.	Protein.	Fat.	Crude fiber.	Sugar.	Ash.	Other substances.	Yield per acre.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Bu.*
Carrots, (14 samples):								
Average	88.24	.97	.23	1.06	5.52	.80	3.29	517.5
Range	85.41–91.08	.67–1.52	.14–.37	.86–1.35	3.69–6.30	.56–1.25	2.47–4.57	....
Kohl-rabi (12 samples):								
Average	89.08	1.23	.23	1.22	5.71	.60	2.00	701.5
Range	86.58–90.87	.75–1.82	.16–.39	.92–1 62	4.88–7.18	.41–.82	.68–2.97	....
Turnips, yellow flesh (22 samples):								
Average	91.12	.81	.20	1.08	5.10	.74	1.81	1,058.0
Range	89.07–92.85	.69–1.88	.10–.30	.82–1.61	2.52–6.24	.52–.95	1.16–2.71	....
Turnips, white flesh (9 samples):								
Average	92.80	.88	.17	.98	3.34	.63	1.08	1,150.0
Range	91.67–93.71	.66–1.08	.11–.26	.73–1.20	2.81–4.12	.48–.89	.77–1.85	....
Fodder beets (10 samples):								
Average	85.70	1.23	.17	.90	8.68	.99	2.37	1,265.0
Range	81.64–89.73	.91–1.72	.07–.53	.74–1.08	6.95-11.28	.77–1.14	.44–4.39	....

—F. W. WOLL.

The soluble starches, W. SYNIEWSKI (*Ber. Deut. Chem. Gesell.*, *30* (*1897*), *No. 16*, *pp. 2415–2418*).—The author suggests a new method for the determination of soluble starches. Fifty grams of commercial sodium peroxid is dissolved in 500 gm. of cold water and mixed with 50 gm. of potato starch in 500 gm. of water. The jelly-like mass, which is filled with gas bubbles, is placed in cold water and shaken from time to time. After an hour the mass becomes completely fluid, the vigorous evolution of gas which has kept up meanwhile forming a scum on the surface of the liquid. A quantity of 95 per cent alcohol is then added to the solution, which causes the formation of a tenacious, sticky precipitate. The excess of solution is drawn off and the precipitate dissolved in cold water, the solution cooled, and acetic acid added drop by drop until neutral. If too much alcohol has not been used, hydrochloric acid may be used instead of acetic acid. The precipitate is again dissolved in water and acidified on cooling. After repeated precipitation in this manner a solution is finally obtained with scarcely a trace of ash. The water solution of this final product is allowed to stand for some time, when a small amount of a flocculent yellow precipitate appears and the supernatant liquid becomes perfectly clear. From this solution the starch is precipitated by 95 per cent alcohol, rubbed up with alcohol, collected on a filter, washed with water-free ether, and finally dried in a heated vacuum. In this way a snow-white amorphous body without odor or taste was obtained, of the approximate formula, $3C_6H_{10}O_5.H_2O$.

This substance is easily soluble in cold water. It was impossible to keep a solution stronger than 12.5 per cent at ordinary temperature. In warm water it appeared to dissolve in any proportion. It gave a clear blue color with iodin, and was not changed by prolonged heating. It did not reduce Fehling's solution. It rotated the polarized light to the right, the specific rotation varying with the concentration.—J. P. STREET.

Chemical department, R. DE ROODE (*West Virginia Sta. Rpt. 1892, pp. 18–35*).—The work of the year in this department of the station is briefly summarized, and an account is given of a comparison of the author's method[1] for determining phosphoric acid and nitrogen in the same sample with the official methods on a large number of fertilizing materials.

"The results thus far seem to indicate very clearly that very accurate results may be obtained by determining the total phosphoric acid in a portion of the same solution in which the nitrogen is to be estimated; and that this is the case whether the plain Kjeldahl or the Gunning modification is used; or in case nitrates are present, whether zinc dust, zinc sulphid, or hyposulphite of soda is used. . . .

"As to the question of the use of permanganate of potassium, [in the author's opinion the results obtained] show beyond any doubt that its use is entirely without effect upon the percentage of the nitrogen obtained, even though used very liberally. However, if it should still be deemed necessary by some chemists, its use may be continued, its bad effects upon the determination of the phosphoric acid in the same solution being destroyed by the addition of a solution of oxalic acid in quantities just sufficient to accomplish the purpose, before diluting up to the mark or by other means."

The Burney method of solution (in sulphuric acid with the addition of potassium nitrate) in the determination of phosphoric acid gave fully as accurate results as solution in nitric and hydrochloric acids.

The author describes the following laboratory apparatus: Kjeldahl distillation flask covered with asbestos, siphon wash bottle, filtering tubes to be used in place of Gooch crucibles for potash determinations, and a pipette for use in the author's application of the Kjeldahl method to the determination of phosphoric acid and nitrogen, which is so graduated that the necessity for correction or calculation is obviated should the strength of the ammonia solution not be exactly 1.4 gm. of nitrogen per liter.

Spontaneous combustion of hay, G. C. WATSON (*Pennsylvania Sta. Rpt. 1896, pp. 55, 56*).—The author reports in detail an apparent case of spontaneous combustion of hay in one of the college barns.

[1] West Virginia Sta. Rpt. 1891, p. 21 (E. S. R., 9, p. 721).

The action of formic aldehyde on albumen, gelatin, and peptone, and its use in the analysis of foods and condiments, H. SERTZ (*Inaug. Diss., Erlangen; abs. in Hyg. Rundschau, 7 (1897), No. 22, p. 1135*).

On the effect of heating protein with water under pressure, E. SALKOWSKI (*Ztschr. Biol., 34 (1897), pp. 190–295*).

Investigations on protein: I. Iodated egg albumen, F. HOFMEISTER (*Ztschr. Physiol. Chem., 24, No. 1–2, pp. 159–172*).

The noncoagulable protein in muscles, K. MAYS (*Ztschr. Biol., 34 (1897), pp. 268–297*).

Contributions to the chemistry of protein precipitation, H. SCHJERNING (*Ztschr. Analyt. Chem., 36 (1897), No. 10–11, pp. 643–663*).

Contribution to the subject of the cleavage of casein by hydrochloric acid, T. PAUZER (*Ztschr. Physiol. Chem., 24, No. 1–2, pp. 138–141*).

A contribution to the biological history of phosphates, L. JOLLY (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 15, pp. 538, 539*).—Repeated maceration of sheep flesh in acetic and dilute nitric acids failed to remove all phosphoric acid, the treated flesh showing a decided yellow coloration on treatment with molybdic solution. The author therefore concludes that part of the phosphorus is in fixed combination.

The detection of gelatin in cream, A. W. STOKES (*Analyst, 22 (1897), Dec., p. 320*).—The suspected cream is mixed with an equal volume of a dilute solution of mercury in nitric acid and the whole vigorously shaken. The mixture is allowed to stand 5 minutes and then filtered. To the filtrate an aqueous solution of picric acid is added. If gelatin be present a yellow precipitate is immediately produced. The test is a delicate one and may be quickly applied.—L. H. MERRILL.

The estimation of boric acid in meat preparations, G. POPP and C. FRESENIUS (*Ztschr. Öffentl. Chem., 3 (1897), p. 188; abs. in Vrtljschr. Chem. Nahr. u. Genussmtl., 12, No. 2, pp. 156, 157*).

Determination of lactic acid, ULZER and SEIDEL (*Rev. Internat. Falsif., 1897, No. 5; abs. in Milch Ztg., 26 (1897), No. 47, p. 749*).

Fehling's solution, M. Z. IOVITSCHITSCH (*Ber. Deut. Chem. Gesell., 30 (1897), No. 16, pp. 2431, 2432*).

Fehling's solution, J. E. GEROCK (*Ber. Deut. Chem. Gesell., 30 (1897), No. 18, pp. 2865–2867*).

Experiments concerning the change of butyric acids into isobutyric acids, R. HUTZLER and V. MEYER (*Ber. Deut. Chem. Gesell., 30 (1897), No. 16, pp. 2519–2529*).

The content of pentosans and other carbohydrates in turf, H. VON FEILITZEN and B. TOLLENS (*Ber. Deut. Chem. Gesell., 30 (1897), No. 17, pp. 2571–2576*).

Description of the principal methods for determining heat of combustion, W. LONGUININE (*Beschreibung der Hauptmethoden welche bei der Bestimmung der Brennungswärme üblich sind. Berlin: R. Friedlander & Co., 1898, pp. 112, pls. 4, figs. 21*).

Changes in and additions to methods of analysis adopted at the 13th and 14th annual meetings of the Association of Official Agricultural Chemists, H. W. WILEY (*U. S. Dept. Agr., Division of Chemistry Circ. 4, pp. 10*).—These changes have been noted in the account of the proceedings of this convention already published in the Record (E. S. R., 8, p. 272; 9, p. 404).

Investigations on the quantitative estimation of grape sugar, E. PFLÜGER (*Arch. Phsyiol. [Pflüger], 69, No. 9–10, pp. 399–471, fig. 1*).

The extraction of fluids, A. WROBLEWSKI (*Ztschr. Analyt. Chem., 36 (1897), No. 10–11, pp. 671–674, figs. 2*).—The author describes an apparatus designed for the exhaustive extraction of fluids, in which the vapors of the ether or other solvent employed are forced through the fluid to be extracted. The consequent warming of the fluid, together with the agitation effected by the passage of the vapors, greatly facilitates the extraction.—L. H. MERRILL.

Miscellaneous analyses, J. L. HILLS, B. O. WHITE, and C. H. JONES (*Vermont Sta. Rpt. 1896–'97, pp. 32, 33*).—These include analyses of 3 samples of material suspected of being oleomargarine, 4 of maple sirup, 1 each of maple sugar and sap, 5 of adulterated honeys, and 11 of mill feeds, the latter including "wheat by-product," oat feed, flax meal, cream and Atlas gluten meal, middlings, buckwheat hulls, and mixed feed.

BOTANY.

Contributions to the life history of Amphicarpæa monoica, ADELINE F. SCHIVELY (*Contrib. Bot. Lab. Univ. Pennsylvania, I, No. 3, pp. 270–363, pls. 18*).—The author has made a very comprehensive study of the life history of this plant, which, as was already known, bears both aerial and subterranean fruits. In the present study it was established that 4 distinct types of pods and flowers were developed, 3 being borne above ground and the other subterranean. The aerial flowers, which are characteristically different, develop different kinds of pods. A dimorphism resulting from the germination of the subterranean and aerial seeds is also established, it being decidedly noticeable in the case of plants grown during the winter and to a less degree in those grown in the open during summer. It was found that the aerial cleistogamic flowers or young pods may be converted into the subterranean forms by burying them in the soil.

A chemico-physiological study of Spirogyra nitida, MARY E. PENNINGTON (*Contrib. Bot. Lab. Univ. Pennsylvania, I, No. 3, pp. 203–259*).—The author gives the results of a study of the chemistry and physiology of *Spirogyra nitida*, in which some very interesting facts are brought out. The conjugative cells show a widely different chemical composition from the vegetative cells. The action under colored screens modified the chemical composition of the alga according to the rays of light received.

"Violet rays prevented almost wholly the hydration of starch, and soon killed the plant. Blue rays gave an imperfect hydration, but sufficient to preserve life for some time. Starch was not formed in the cells. Green rays caused an active assimilation with a continuous growth and unusual protoplasmic motility. The protoplasm was also in increased quantity. Green light favored the production of crystals, particularly of calcium tartrate. Yellow rays caused elongation of the cells, which contained abnormal quantities of soluble carbohydrate, but no starch, no tannin, and no crystals. The cells were short lived. Orange rays caused a good growth closely approximating the normal. Crystals were not plentiful, however, and the sugar was in rather large quantity. Red rays caused a growth which was even more rapid than that made in white light. Tannin was formed in larger quantities than under the normal conditions."

On the structure and pollination of the flowers of Eupatorium spp., LAURA B. CROSS (*Contrib. Bot. Lab. Univ. Pennsylvania, I, No. 3, pp. 260–269, pl. 1*).—The author has made a study of *Eupatorium ageratoides* and *E. cœlestium* to determine the question of their pollination. It was found that self-pollination in species of Eupatorium is very rare indeed, and that when it does occur the resulting fruits have a very weak germinative capacity. When close pollination by hand was effected a slight increase of good fruits was obtained; but when covered flowers were cross-pollinated the increase was very striking.

The correlation of growth under the influence of injuries, C. O. TOWNSEND (*Ann. Bot., 11 (1897), No. 44, pp. 509–532*).—The author has reported on a series of experiments to test the first effects of injury upon the growth of plants, to determine the effect of a single irritation of short duration, and the time required for such an effect to manifest itself. The well-known effect of the removal of the branches of a tree on the development of other branches or the development of fruit and the disturbance of the roots of garden plants through cultivation are mentioned. The experiments for the most part were conducted with seedlings of *Phaseolus multiflorus*, *Vicia faba*, *Lupinus albus*, *Helianthus annuus*, *Cucurbita pepo*, *Zea mays*, *Avena sativa*, *Hordeum vulgare*, and *Secale cereale;* also with older plants of Calla and a few cuttings of willows. A number of experiments were also made with *Phycomyces nitens.* The different experiments are reported upon in detail, and the following summary is given:

"A single irritation produced by cutting or splitting the shoots or roots or removing the leaf tips of seedlings tends to produce a change in the rate of growth of the injured and of the uninjured parts.

"If the injury is slight, signs of an acceleration in the rate of growth will be apparent in from 6 to 24 hours, and will continue for from 1 to several days. If the injury is severe, the acceleration will be preceded by a period of retardation of longer or shorter duration, depending upon the severity of the injury and upon the condition of the plant injured.

"The growth of the stems of older plants is accelerated by removal of a number of the roots or leaves, but is not affected by a slight injury to the roots.

"The roots of older plants as well as of seedlings are more independent than are the stems or shoots.

"The change in the rate of growth of higher plants under the influence of a single irritation begins gradually, reaches its maximum in from 12 to 96 hours, and gradually diminishes until the normal rate is resumed.

"A dilute but continuous atmosphere of ether, or a strong shock of ether of short duration, will produce an acceleration in growth.

"The total variation in the growth of higher plants due to the influence of a single irritation is from 0 to 70 per cent of the normal growth for the same period.

"The growth of sporangium stalks of Phycomyces is suddenly and strongly retarded by cutting either the mycelia or another sporangium stalk on the same plant. The growth does not entirely cease, and gradually recovers its normal rate in from 30 to 60 minutes.

"The influence of an irritation due to cutting or other injury is capable of acting through a distance of several hundred millimeters."

Periodicity of root pressure, M. B. THOMAS (*Proc. Indiana Acad. Sci., 1896, pp. 143–147*).—The author gives in this paper, which is an abstract of a more detailed presentation of the subject, the following general conclusions:

"The periodicity of root pressure seems to be inherent in the plant, and has either been acquired by previous adaptation to environments, or as the results of the action of some constant or periodic changes in the plant. As with the periodicity of growth and other periodic phenomena, it does not always follow that periodic change has not been produced by some constantly or continuously acting agent.

"Root pressure does not seem to have any relation to the previous periodicities of the vital activities of the plant when the top was connected with the roots. The measure of the root pressure seems to be the osmotic activity of the root hairs, and is probably due to the presence of organic acids and other substances in the rhizoids that show great affinity for water. Although the organic acids increase in the cells at 50 to 60° F., yet their increase does not seem to make any appreciable difference in the periodicity. This is true even when the temperature of the soil is brought up to 55° F., approaching the time of minimum pressure.

"The fact that seems inexplicable is that, when the temperature is raised above the point where the organic acids decompose (60° F.) in most plants, the roots may show an increase in their osmotic activity at the daily period of maximum pressure. The absence of a top to the plant and its consequent loss of periods of maximum and minimum oxidation, which are the real causes of the variation in the quantity of organic acids in the cell, may be the reason for the failure to produce the expected results. The time of periodicity of root pressure is constant in the same genus, but some species may show greater absolute pressure than others. This may be due to accidents in growth, etc. The fact of the periodicity of root pressure seems to be established beyond the possibility of a doubt, and capillarity and similar phenomena can not account for the facts observed."

The amount of nitrogen conveyed by red clover to different kinds of soil, N. PASSERINI (*Bol. Scuola Agrar. Scandicci, 1895, No. 3, pp. 102-111; abs. in Jour. Chem. Soc. [London], 72 (1897), No. 421, II, p. 587*).—A report is given of experiments with red clover grown in wooden boxes containing 3 different kinds of soil—sandy, clayey, and calcareous. There was a decided loss in nitrogen in the soil at the end of the experiments in the case of the sandy and clayey soils, but a gain in the calcareous soil. The loss is at least in part attributed to a loss of nitrates in drainage and possibly a less active fixation of nitrogen.

Nitrogen nutrition of the Leguminosæ, K. VON ROZDEJCZER (*Inaug. Diss., Leipzig; abs. in Jour. Chem. Soc. [London], 72 (1897), No. 421, II, pp. 586, 587*).—A report is given of experiments in which peas were grown in sandy, loamy, and humus soils. There were 3 series of experiments. In the first the pots were unmanured, in the second they were manured with mineral manure and sodium nitrate, and in the third with mineral fertilizer without sodium nitrate. The pots were kept in the open air except during very wet weather, and the amount of nitrogen in the rain and water used was determined.

On taking up the plants the greatest tubercle development was found in the pots which had received chemical fertilizers and in the unmanured sandy soil, the development being slight in the loamy and humus soils and very poorly represented in the pots receiving sodium nitrate. A summary shows the average amount of nitrogen in the soil, seed, and produce, and also the gain or loss at the end of each experiment. A gain in nitrogen was indicated in every series except that of the loamy soil which received the sodium nitrate, in which there was a loss.

The author concludes that with insufficient nitrogen in the soil peas assimilate considerable amounts of free nitrogen, but with an increased supply of soil nitrogen the power of fixing free nitrogen diminishes, the plants utilizing the combined nitrogen of the soil. With rich soils elementary nitrogen is either not utilized at all or in very small quantities. The author states that leguminous crops should be well manured with potash and phosphoric acid.

The plants of saline soils, A. FERET (*Monde des Plantes, 2. ser., 7 (1897), No. 95, pp. 182–184*).

New or noteworthy American grasses, G. V. NASH (*Bul. Torrey Bot. Club, 25 (1898), No. 2, pp. 83–89*).

Sex in plants, J. HOOPES (*Pennsylvania Dept. Agr. Bul. 30, pp. 17, figs. 9*).—A popular presentation of the subject is given, with suggestions and directions for hybridizing.

Investigations in the bark of trees, T. MEEHAN (*Pennsylvania Dept. Agr. Bul. 29, pp. 17, figs. 7*).—The author gives his views relative to the nature, development, and functions of the bark of trees.

On the cause of the movement of sap in plants, A. MAYER (*Forsch. Agr. Phys. [Wollny], 20 (1897), No. 1, pp. 213–217*).

The roots of plants, W. A. BUCKHOUT (*Pennsylvania Dept. Agr. Rpt. 1896, pp. 549–557, figs. 5*).—The author popularly describes the growth and functions of roots and their relations to their surroundings.

Investigations on geotropic sensitive roots, F. CZAPEK (*Ber. Deut. Bot. Gesell., 15 (1897), No. 10, pp. 516–520*).

On the repression of vertical growth in secondary roots, A. SCHOBER (*Bot. Ztg., 56 (1898), No. 1, pp. 1–8, figs. 2*).

Investigations on year ring formation in the red beech, B. WALTER (*Forstl. Naturw. Ztschr., 7 (1898), No. 1, pp. 19–32*).

The mycorrhizæ of Aplectrum, D. T. MACDOUGAL (*Bul. Torrey Bot. Club, 25 (1898), No. 2, pp. 110–112*).

A contribution to the physiology of tendrils, D. T. MACDOUGAL (*Bul. Torrey Bot. Club, 25 (1898), No. 2, pp. 65–72, figs. 7*).

Concerning a proteid spindle-shaped body in the family Balsamineæ, G. AMADEI (*Bot. Centbl., 73 (1898), Nos. 1, pp. 1–9; 2, pp. 33–41, pls. 2*).—Describes spindle-shaped bodies observed in Impatiens and other genera of this family.

Morphological and anatomical studies in the Cyperaceæ, T. HOLM (*Amer. Jour. Sci., 4 ser., 4. (1897), pp. 13–26, 298–305, figs. 24; 5 (1898), pp. 47–52, figs. 5*).—Notes are given of *Fuirena squarrosa, F. scirpoidea, Dichromena leucophylla, D. latifolia,* and *Scleria* spp.

Anatomical studies of galls, H. FOCKEN (*Recherches anatomiques sur les galles. Étude de quelques diptérocécidies et acarocécidies. Thesis. Lille: Le Bigot frère, 1896, pp. 164*).

On the accidental production of a red coloring material in cultures of Mucor racemosus, P. A. DANGEARD (*Botaniste, 5. ser., 1897, No. 6, pp. 318, 319*).

The movement of protoplasm in cœnocytic hyphæ, J. C. ARTHUR (*Ann. Bot., 11 (1897), No. 44, pp. 491–507, figs. 4*).—The author describes a movement of the protoplasm in the hyphæ of several of the molds. It involves all the contents and is thought to aid very materially in the distribution of the nutrient material to points of growth. The paper was read before the Botanical Society of America at the Toronto meeting, August, 1897.

Concerning the transformation of proteids in living plants, E. SCHULZE (*Ztschr. Physiol. Chem., 24, No. 1–2, pp. 18–114*).

Concerning the resting period and some conditions for the germination of Viscum, J. WIESNER (*Ber. Deut. Bot. Gesell., 15 (1897), No. 10, pp. 503–516*).

The morphology of the Blastomycetes, O. CASOGRANDI (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), Nos. 23–24, pp. 634–639; 25–26, pp. 718–722*).

A contribution to the study of malate and malophosphate of lime in plants, M. MIRANDE (*Jour. Bot. [Paris], 12 (1897), Nos. 1, pp. 6–12; 2, pp. 32–36, figs. 4*).

The effect of one-sided applications of nitrogen fertilizer, P. SORAUER (*Ztschr. Pflanzenkrank., 7 (1897), No. 5, pp. 287–290*).—Comparisons of the different plant tissues are made, to show the effect of the addition of a comparatively large amount of sulphate of ammonia to pots in which fuchsias were grown.

The action of denitrifying bacteria toward some carbon compounds, H. JENSEN (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), Nos. 23–24, pp. 622–627; 25–26, pp. 689–698*).

Fixation of atmospheric nitrogen by dead leaves, L. DÉTRIE (*Bul. Soc. Cent. Forst. Belg., 5 (1898), No. 1, pp. 36–38*).

The proteolytic enzym of Nepenthes, S. H. VINES (*Ann. Bot., 11 (1897), No. 44, pp. 563–584*).—The author believes the proteolytic digestion which takes place in pitcher plants is due to an enzym and not to bacteria. In Nepenthes he found that fibrin was digested in the presence of 1 per cent of hydrocyanic acid and that the activity of the ferment is retained for several weeks in pure glycerin.

A new bigeneric hybrid, S. KORSHINSKY (*Bul. Acad. Impér. Sci. [St. Petersbourg], 5. ser., 6 (1897), No. 4, pp. 322–324, pl. 1*).—A hybrid of *Cucumis melo* and *Citrullus vulgaris* is described.

FERMENTATION—BACTERIOLOGY.

The bacteriological flora of the air in stables, A. W. BITTING and C. E. DAVIS (*Proc. Indiana Acad. Sci., 1896, pp. 172–184, pls. 5*).—The authors report studies conducted to determine the number of bacteria found in the air of stables, and to determine whether a relationship exists between the number of germs found in air and the sanitary condition of the place. Ten barns and stables were selected, representing different sanitary conditions, and 15 tests of the air were made inside the buildings and a corresponding number in the open air at the same time. The average number of colonies developed per liter from the air inside the stables was 86, as compared with 27 from the outside air. Thirty tests were made by Petri dish exposures for 2 minutes each in the air inside the stables and 15 tests in the open air. The average number of colonies on the plates exposed inside the stables was 174, and 55 on those exposed outside.

It was found that the number of germs per liter of air could not be taken as an index of the sanitary surroundings, as the dust caused by feeding, moving of bedding, currying, etc., have more to do with the number of germs which will be drawn into a Hesse tube or fall on a Petri dish than lack of ventilation has.

Detailed descriptions are given of 18 forms of bacteria collected in the different stables.

Studies on nitrification, H. WEISSENBERG (*Arch. Hyg., 30 (1897), No. 3, pp. 274–289; abs. in Chem. Ztg., 21 (1897), No. 85, Repert., p. 231*).—Studies of the *Bacillus denitrificans* I and II of Stutzer and Burri, or, adopting the nomenclature of Lehmann and Neumann, *B. denitrificans* and *B. stutzeri*, were made under varying conditions in different culture media. It appears from these studies that, as Stutzer and Burri claim, the first of these organisms denitrifies only when acting in symbiosis with other organisms which reduce nitrates to nitrites, such as *Bacillus coli* or *B. typhi*. The second organism, *B. stutzeri*, in comparative tests with *B. pyocyaneum* from different sources behaved like the latter in every case, denitrifying nitrates directly without the intervention of other organisms. In the reduction of the nitrates the oxygen is seized by the organism, the nitrogen escapes, and sodium hydroxid is formed, increasing the alkalinity of the medium. This process is checked by the introduction of a liberal supply of air (oxygen). In the reduction of nitrates to nitrites the oxygen is not taken up directly by the cells of the organisms. The presence of acids and alkalies checks the action of the denitrifying organisms.

Principles of bacteriology, A. C. ABBOTT (*Philadelphia: Lea Bros. & Co., 1897, 4 ed., rev. and enl., pp. 542*).—A manual of bacteriology for students and physicians.

On the germination of bacteria spores, G. GRETHE (*Fortschr. Med., 1897, No. 2, p. 43; abs. in Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 23–24, pp. 678, 679*).

Concerning the vitality of bacteria in dust and soil, P. MIQUEL (*Ann. Microg., 9 (1897), No. 5, pp. 199–207*).

Growth of the tubercle bacillus at a low temperature, F. J. REID (*Nature, 57, No. 1421, p. 211*).—A slow but perfect growth at 18 to 20° C. is reported.

Agricultural chemical investigations on the changes in certain culture media by the action of agriculturally important bacteria, O. BIERNATH (*Inaug. Diss., Rostock, 1897, pp. 79*).

Does the volume of the liquid change as a result of alcoholic fermentation? T. KOSUTANY (*Landw. Vers. Stat., 49 (1897), No. 3, pp. 173–192*).

Fermentation experiments with turf, H. VON FEILITZEN and B. TOLLENS (*Ber. Deut. Chem. Gesell., 30 (1897), No. 17, pp. 2577–2581*).

METEOROLOGY.

Monthly Weather Review (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 25 (1897), Nos. 10, pp. 425–470, figs. 2, charts 4; 11, pp. 471–516, figs. 5, charts 9; 12, pp. 519–568, figs. 6, charts 7*).—Besides the usual meteorological summaries, No. 10 contains special articles on Wind and clouds, by M. Brillouin (translated from the French[1]); Climate as a controlling factor in long distance transmission of electrical energy, by A. G. McAdie; Atmospheric electricity, its origin, variations, and perturbations, by M. Brillouin (translated from the French[2]); The area of heavy rainfall in the southern Appalachians, by B. C. Hawkins; Photographic apparatus for measuring the altitudes attained by balloons, by L. Cailletet (translated from the French[3]); and notes by the editor on mountain stations in North Carolina; hydrodynamic equations for the atmosphere; raindrops, their size and rate of fall; atmospheric electricity—Brillouin's theory; hurricanes in the West Indies; altitudes of clouds; origin of the descending gusts of wind; recent earthquakes, and distant cloud banks.

No. 11 contains special articles on A winter barograph curve from the South Pacific Ocean, by R. De C. Ward; and An improved sunshine recorder, by D. T. Maring, and notes by the editor on the kite in France, local climatic changes, the celebration of the semicentennial of the Royal Prussian Meteorological Institution, recent earthquakes, and Weather Bureau station on Mount Tamalpais.

No. 12 contains special articles on A preliminary discussion of certain cyclical changes in India, by W. L. Dallas (figs. 6); and The elec-

[1] Ann Chim. et Phys., 7. ser., 11 (1897), pp. 145–153.
[2] Rev. Gén. Sci. Pures et Appl., 1897, Aug. 30.
[3] Compt. Rend. Acad. Sci. Paris, 125 (1897), pp. 587–589.

trical storms of California, by A. J. Barwick; and notes by the editor on mechanical determination of resultant wind, the meteorological stations of Harvard University, meteorology in the United States Geological Survey, recent earthquakes, electric storms at Sacramento, distant cloud banks, cloudy condensation, cycles in meteorology, water measurements for irrigation, and chinooks in Iowa.

Meteorology of 1896, W. S. SWEETSER (*Pennsylvania Sta. Rpt. 1896, pp. 225–229, 238–246, 251–273*).—"The work of the past year has been merely a continuation of the work of the preceding years [E. S. R., 8, p. 754], including the observations usually called for by the United States Weather Bureau upon atmospheric conditions, and also observations upon soil temperature at various depths [see p. 819] and upon the daily duration of sunshine." The annual summary is as follows:

Summary of meteorological observations, 1896.

	Year 1896.	Growing season (Apr.–Sept., 1896).
Barometer (inches):		
Mean	30.050	
Highest	30.861 (Dec. 29)	
Lowest	28.948 (Feb. 6)	
Temperature (° F.):		
Mean	49.5	64.2.
Highest	93 (Aug. 9)	93 (Aug. 9).
Lowest	6 (Feb. 17)	21 (Apr. 3).
Mean daily range	17.7	19.5.
Greatest daily range	39 (May 9)	39 (May 19).
Least daily range	4 (Jan. 24, 25)	
Mean daily relative humidity (per cent)	81.8	77.3.
Rainfall (inches):		
Total	35.28	20.
Greatest monthly	5.56 (July)	5.56 (July).
Greatest daily	2.40 (Sept. 30)	2.40 (Sept. 30).
Number of days on which 0.01 in. or more of rain fell	132	69.
Mean percentage of cloudiness	60.0	55.5.
Number of days on which cloudiness averaged 80 per cent or more.	138	62.
Average hours of sunshine per day		4 h. 59 m.
Wind (miles):		
Total movement	25,340	
Maximum velocity	28 (Feb. 6)	
Greatest daily movement	435 (Mar. 2)	
Last frost in spring		Apr. 23.
First frost in fall		Sept. 24.

Principal periods of crop development.

Wheat:
- Seeded, September 1–6, 1895.
- In bloom, June 1, 1896.
- Ripening, June 12.
- Cut, July 3.

Corn:
- Planted, May 4.
- In silk, July 24.
- Cut, September 11.
- Husking begun, September 25.

Clover:
- In bloom, May 29.
- Cut, June 20.

Oats:
- Seeded, April 15–24.
- Ripening, July 17.
- Cut, July 20–24.

Potatoes:
- Planted, May 15.
- Late varieties harvested September 25.

Grass:
- In bloom, June 5.
- Cut, June 26.

Floods of the Mississippi River, P. MORRILL (*U. S. Dept. Agr., Weather Bureau Doc. 143, pp. 79, pls. 61, figs. 3*).—This paper discusses the floods of the Mississippi in general, but gives especial attention to the flood which occurred during the spring of 1897.

"The effort has been made to briefly cover the entire regimen of the river, both in its normal condition and in flood. The physical characteristics of the Mississippi basin and river have been reviewed, and the best data available as to area of watersheds, dimensions, and slope of the main stream and its tributaries are given, largely in tabular form, convenient for reference. The records of the Weather Bureau have been used to determine the normal precipitation for each month and for the year. . . . The resultant downfall of water over the various subdivisions of the grand basin has been computed, and is presented in tables. Normal river stages at various stations have been computed, and are here published for the first time, so far as known. The chart of normal hydrographs drawn from these data is instructive, showing at a glance the annual rise and fall of the Mississippi and its chief feeders. Other facts as to the extreme stages of the rivers, the volume of discharge, and similar matters have been collected from many sources, and are presented in convenient form.

"Having treated of the normal conditions of water supply and drainage throughout the basin, the subject of floods is next considered at some length. The floods occurring during the past 26 years are made the chief subject of study, inasmuch as only during that time are complete and reliable gauge readings available. Six notable flood years are embraced in this period, and for these 6 floods hydrographs have been drawn for several typical stations. The downfall of water from which each flood arose has been computed, and the results are given in tabular form. Corresponding charts of actual precipitation and of the departure from the normal precipitation have also been constructed for each flood, and accompany the report. Through our own observers, and from the investigations of the engineer officers in charge of levee work, a map of the region inundated this year has been prepared, and forms an interesting accompaniment to the paper."

The highest kite ascensions at Blue Hill, S. P. FERGUSSON (*U. S. Dept. Agr., Weather Bureau Doc. 145, pp. 4*).—"On September 19, 1897, the kite meteorograph was raised to a height of 2,821 meters (9,255 ft.) above the summit of the Hill, or 3,013 meters (9,885 ft.) above sea level. The highest kite was 40 meters (131 ft.) above the meteorograph, or 3,052 meters (10,016 ft.) above sea level. The height reached by the meteorograph was 510 ft. higher than that reached on October 8, 1896."[1]

Meteorological observations (*Canada Expt. Farms Rpts. 1896, pp. 61, 297, 375, 421–423, 459*).—Notes on the weather and monthly summaries of observations on temperature and precipitation during 1896 at the experimental farms in the different provinces of Canada.

Meteorological report for 1895, J. C. RANE (*West Virginia Sta. Rpt. 1895, pp. 50–53*).—Monthly summary of observations on temperature, precipitation, direction of wind, etc., for the period from June, 1894, to April, 1895.

Meteorological observations, L. H. MERRILL (*Maine Sta. Rpt. 1896, p. 127*).—This is a summary of observations on temperature, atmospheric pressure, precipitation, and cloudiness during the 6 months ending December 31, 1896. The maximum pressure during this period was 30.6 in., the minimum 29.6 in., the mean 30.14 in. The highest temperature was 74° F., the lowest 22°, the mean 48°.

[1] See also Monthly Weather Review, 25 (1897), No. 9, p. 392.

Monthly reports of the River and Flood Service for September, October, November, and December, 1897, P. MORRILL (*U. S. Dept. Agr., Weather Bureau Docs. 137, pp. 11, chart 1; 144, pp. 11, chart 1; 147, pp. 13, chart 1; 151, pp. 13, chart 1*).—(See also Monthly Weather Review, 25 (1897), Nos. 9, p. 389; 10, p. 434; 11, p. 479; 12, p. 529).

Forest and rainfall, H. A. HAZEN (*U. S. Dept. Agr., Weather Bureau Doc. 140, pp. 7*).—It is claimed in this paper that while forests have "a most important bearing upon the conservation of rainfall" their effect upon precipitation "if there be one, is almost inappreciable. . . . From the evidence already accumulated there would be very little to be gained by a further study of the question."

Instructions to operators on the United States seacoast telegraph lines, J. H. ROBINSON (*U. S. Dept. Agr., Weather Bureau Doc. 134, pp. 26*).—These lines were "built for the benefit and better protection of commerce at large, in conveying information and warning of approaching storms and summoning aid in cases of marine disaster . . . [and] are, by law, in the charge and control of the Chief of the Weather Bureau, with respect to their maintenance and operation."

A winter barograph curve from the South Pacific Ocean, R. DE C. WARD (*U. S. Dept. Agr., Weather Bureau Doc. 149, pp. 6, fig. 1*).—A curve obtained with a small-sized Richard Freres barograph during a winter voyage through the Straits of Magellan and upon the west coast of South America as far as Corral, Chile (latitude 39° 52′ S.; longitude 73° 17′ W.).[1]

An improved sunshine recorder, D. T. MARING (*U. S. Dept. Agr., Weather Bureau Doc. 148, pp. 15, pl. 1, figs. 4*).—This is a detailed description, accompanied by figures, reprinted from the Monthly Weather Review, 25 (1897), No. 11, p. 485.

The probable state of the sky along the path of total eclipse of the sun May 28, 1900, F. H. BIGELOW (*U. S. Dept. Agr., Weather Bureau Doc. 142, pp. 7, chart 1*).

Instructions governing the corn, wheat, cotton, sugar, and rice region service, J. BERRY (*U. S. Dept. Agr., Weather Bureau Doc. 133, pp. 9*).

WATER—SOILS.

The rocks and soils of Grenada and Carriacou, J. B. HARRISON (*London: Waterlow & Sons, Ltd., 1896, pp. 1–30, 57–60*).—This is an account of a brief study of the geology, rocks, and soils of these two islands of the Windward group. At present only soils derived from the decomposition of lavas are cultivated. In order to study the changes which have occurred in the course of the disintegration of these lavas and the formation of the soil, bulk analyses were made of the various typical kinds of lavas and of soils which were clearly derived from two of them.

"In the soils from the hornblende andesites it is seen by this method that a very heavy loss of silica has ensued, an apparent increase of over 30 per cent has taken place in the oxids of iron, and that the state of oxidation of the major part of the iron has been changed from protoxid to peroxid; that nearly two-thirds of the manganese oxid, over three-quarters of the lime, one-quarter of the magnesia, eight-ninths of the potash, five-sixths of the soda, and nearly two-thirds of the phosphoric anhydrid have been lost, while the amount of water and organic matters are approximately four times greater than in the rock. The increase in the oxids of iron, which in the part of the soil not dissolved by hydrochloric acid are principally present in the form

[1] See also Monthly Weather Review, 25 (1897), No. 11, p. 484.

of small heavy grains of magnetite, leads to the conclusion that the loss has not been alone by the removal by drainage of the constituents rendered soluble by oxidation and other chemical changes, but largely by the removal of some of the lighter argillaceous products by surface washing, and this view is upheld by the unexpectedly heavy loss of silica.

"In the case of the soils derived from the more basic lavas, augite andesite with olivine and olivine basalt, nearly one-third of the silica has disappeared, the iron oxids have increased by about one-twelfth, approximately one-sixth of the oxid of manganese, four-fifths of the potash, and three-quarters of the phosphoric anhydrid have been lost, while the amount of water and organic matter are approximately four times the original quantity. The most striking losses have been in the lime, magnesia, and soda, of which, in round numbers, 96, 88, and 94 per cent have been lost, respectively. The low increase in the proportions of the heavy iron minerals tends to show that in the soils of this kind selected for comparison but little loss of the lighter products of decomposition has taken place by surface washing. The noteworthy point is the very high rates of loss of the lime, magnesia, and soda of these basic rocks, probably in solution by drainage, showing that the feldspars, the plentiful augite, and the olivine have suffered very complete decomposition during their degradation."

Analyses of 41 typical soils of the Island of Grenada are reported, showing the mineral constituents soluble on digestion with 20 per cent hydrochloric acid at the boiling point for 5 days, and the phosphoric acid and potash soluble in 1 per cent citric acid on digestion for 5 days in the cold.

"[Of these 41 samples] 26 are deficient in phosphoric acid, in many cases the amount present being very low, while in those in which phosphoric acid is present in fair proportions it is as a rule in a state of very low availability, either on account of its being in a very insoluble state in the form of apatite as it occurs in some of the lavas, or from the low proportion it bears to the quantities of alumina and iron peroxid present. Potash is more or less deficient in 19 of the soils. Nitrogen is deficient in 9 only, most of the soils containing very fair proportions of this constituent, and in 3 cases alone could the amount of total lime present be described as low, although in 19 cases the amount of immediately available lime in the form of carbonate appears to be deficient."

A table is given which classifies the soils with reference to their deficiencies in the different constituents, and suggestions regarding the use of fertilizers are made.

Analyses of 6 Carriacou soils are reported. These soils were found to be rather light loams, fertile, and with excellent drainage, but very susceptible to injury by drought. The rainfall of this island is so low as to render the cultivation of the majority of tropical crops necessarily unsuccessful. "The only promising industry for this island appears to one to be the growth of sisal hemp."

Soil temperatures at different depths, P. SOLLIED (*Norsk Landmansblad, 1896, No. 34, pp. 402–405*).—The observations of the soil temperatures at different depths at the agricultural schools at Aas and Jönsberg, Norway, commenced in 1892 (E. S. R., 6, p. 199), have been continued, and the results for the year November, 1893, to October, 1894, are given. As before, the monthly averages for the thermometer readings have been calculated. They are given in the following table:

Soil temperatures at different depths, by months.

Date.	Aas Agricultural College. Air temperature.	Aas: Soil temperatures at depths of— ¼ meter.	½ meter.	1 meter.	Jönsberg Agricultural School. Air temperature.	Jönsberg: Soil temperatures at depths of— ¼ meter.	½ meter.	1 meter.
1893.	Deg. C.	Deg. C.	Deg. C.	Deg. C.	Deg. C.	Deg. C.	Deg. C.	Deg. C.
November	—3.0	0.9	1.9	4.8	0.0	0.0	0.0	0.0
December	— .5	— .2	.5	2.9	.0	.0	.0	.0
1894.								
January	—2.0	— .4	— .1	2.2	—2.9	—1.3	— .5	.8
February	—1.9	— .9	— .1	1.9	—3.1	3.0 (?)	1.5 (?)	.5
March	1.2	.0	— .1	1.8	— .4	— .7	— .6	.2
April	4.7	4.3	3.1	3.4	4.1	.5	— .1	.3
May	8.6	9.6	8.4	8.1	6.8	6.4	5.3	3.6
June	15.1	13.9	12.5	11.5	13.7	13.6	10.6	8.2
July	17.7	17.7	16.7	15.4	17.1	16.3	15.2	12.3
August	13.4	15.9	15.7	15.0	12.9	14.0	13.9	12.8
September	8.7	11.4	11.8	13.3	6.6	9.5	9.8	10.3
October	2.0	6.2	6.9	10.2	— .4	4.7	5.6	7.2

Both places of observation are in the interior of the country, Jönsberg being situated about 80 miles north of Aas.—F. W. WOLL.

Soil temperatures, W. S. SWEETSER (*Pennsylvania Sta. Rpt. 1896, pp. 230–237, 274–297*).—Tridaily observations during the growing season (Apr.–Sept.) of 1896, with thermometers at the surface and at depths of from 1 to 24 in., are recorded. The following is a summary of the observations:

Soil temperatures, April to September, 1896.

Depth.	Highest.	Lowest.	Daily mean.	Mean daily range.	Greatest daily range.
	Deg. F.	Deg. F.	Deg. F.	Deg. F.	Deg. F.
At surface	92 (Aug. 15, Sept. 11)	27 (Apr. 3)	64.9	12.41	26 (Aug. 30).
1 in. deep	84 (Aug. 11, 15)	30 (Apr. 4)	64.0	8.21	19 (June 3).
3 in. deep	83 (Aug. 11)	32 (Apr. 3, 4, 5, 6)	64.3	6.33	12.5 (Aug. 15).
6 in. deep	80 (Aug. 9, 11)	32 (Apr., 8 days)	63.8	4.06	9.5 (Apr. 13).
12 in. deep	77 (Aug. 11, 12)	32.5 (Apr. 3, 4, 5)	62.6	1.50	4.5 (Apr. 13).
24 in. deep	72.5 (Aug. 12, 13)	33.5 (Apr. 1, 2, 3, 4, 5)	60.7	.30	1.5 (June 18).

Influence of the humidity of the soil on the development of flax, D. N. PRYANISHNIKOV and R. G. TRUBE (*Izv. Moscow Selskokhoz. Inst., 3 (1897), II, pp. 49–51*).—The object of this experiment was to note, in addition to the size of the yield, the influence of the humidity on the form of the plant, character of branching, and the correlation in the development of the roots, stalks, and grain. Twenty-four experiments, divided into 4 groups, with 20, 40, 60, and 80 per cent of the maximum water capacity of the soil, were made. At the beginning of the experiment the watering was done once a day, but later, when the plants began to evaporate more energetically, they were watered 2 or 3 times a day. The differences observed in the yield were not great. This is ascribed to the fact that the frequent watering (2 to 3 times a day) enabled the plants, though growing under different degrees of humidity, to evaporate nearly equal quantities of water.—P. FIREMAN.

On the assimilation of the nitrogen of some organic compounds in sterilized media, D. N. PRYANISHNIKOV and A. N. LYEBYEDYEV (*Izv. Moscow Selskokhoz. Inst., 3* (*1897*), *II, pp. 56–58*).—The substances selected for experiment were such as may get into the soil with the manure or are formed in the plants themselves under certain circumstances, viz, hippuric acid, urea, leucin, asparagin, and aspartic acid. The results of the experiments may be summed up as follows: (1) None of the substances tested approached $Ca(NO_3)_2$ as an effective source of nitrogen either in the sterilized or nonsterilized media; (2) sterilization in all cases reduced the availability of the nitrogen of the organic substances, in most cases no grain being obtained in sterilized media.—P. FIREMAN.

On the oxidation of the ammonia produced by soil organisms, E. DEMOUSSY (*Compt. Rend. Acad. Sci. Paris, 126* (*1898*), *No. 3, pp. 253–256*).—The transformation of organic nitrogen into ammonia and finally into nitrites and nitrates by the action of the microorganisms of the soil was studied in culture solutions containing organic nitrogen in the form of monomethylamin, trimethylamin, anilin, pyridin, and quinolin. As a result of the action of the microorganisms the nitrogenous organic compounds experimented with were reduced by oxidation to simpler forms, finally yielding ammonia which was converted into nitrous and nitric acids. The more complex the compounds used the slower was their transformation. In the case of the monomethylamin perceptible amounts of ammonia were formed within 4 hours, but in the case of the trimethylamin the formation of ammonia proceeded much more slowly. With anilin barely a trace of ammonia was detected after 18 days. With pyridin 2 months elapsed before any ammonia was detected, while with quinolin barely a trace of ammonia was detected after 4 months.

The use of vegetation experiments in soil analysis, H. WILFARTH (*Chem. Ztg., 21* (*1897*), *No. 80, pp. 819, 820*).—Vegetation experiments are stated to be very valuable means of determining the needs of soils, but it is claimed that present methods of conducting them are as a rule too costly and time consuming.

The following is one method suggested: Take samples of the soil to a uniform depth with a cylindrical sampler (8 to 9 cm. in diameter). Place a definite number of these soil samples in a vegetation pot and prepare for the experiment by adding all the elements of plant food except the one whose amount in the soil is to be determined. It is assumed that the plant grown will take up all of this element that is available. The amount thus taken up is shown by analysis of the crop obtained. In this way the amounts assimilable by different crops with different habits of growth may be determined. From the amount found for each pot it is easy to calculate the amount per acre. Such experiments are recommended simply as checks on field experiments.

To lessen the labor and expense of running pots into and out of glass houses, maintaining a uniform water content, etc., the author suggests that the pots be permanently placed on a platform scale which registers the loss of weight (water), thus indicating the amount of water which must be added. For protection against excessive rain the author has arranged a large umbrella which opens automatically when the rainfall reaches a certain amount and closes again when the rain is over. The devices used are described.

The improvement of muck soils, F. T. SHUTT (*Canada Expt. Farms Rpts. 1896, pp. 188, 189, pl. 1*).—A brief report is given of experiments with peas grown in pots on a typical muck soil. One pot received no fertilizer, one received wood ashes at the rate of 100 bu. per acre, one wood ashes at the rate of 200 bu. per acre, and one wood ashes at the rate of 50 bu. per acre and marl at the rate of 50 bu. per acre.

The results indicate that the soils were much improved in fertility by the addition of potash and lime in form of wood ashes and marl. The wood ashes alone appeared to be very effective.

On the relative influence of phosphatic fertilizer on various soils and on the solubility of the phosphoric acid contained in these soils in a 2 per cent citric acid solution, D. N. PRYANISHNIKOV and B. A. SKALOV (*Izv. Moscow Selskokhoz. Inst., 3 (1897), II, pp. 58–61*).—The experiments appear to show that the degree to which soils are affected by phosphatic fertilizer depends to a certain extent upon the amount of phosphoric acid in the soil soluble in a 2 per cent solution of citric acid. The soils poorest in phosphoric acid soluble in this reagent were most reacted upon by the phosphatic fertilizer, while the soils richest in phosphoric acid soluble in 2 per cent citric acid were not at all affected by the fertilizer. The soils with a medium content of such phosphoric acid were influenced to a degree intermediate between the two extremes.—P. FIREMAN.

Analyses of drinking water, J. L. HILLS, B. O. WHITE, and C. H. JONES (*Vermont Sta. Rpt. 1896–'97, pp. 31, 32*).—A table gives results of chemical examinations with regard to sanitary condition of 13 samples each of spring and well water, 4 of driven well water, and 8 of water from ponds, etc. Brief directions regarding sampling and shipping samples are also given.

Analyses of well waters, 1896, F. T. SHUTT (*Canada Expt. Farms Rpts. 1896, pp. 216–221, fig. 1*).—Analyses with reference to sanitary condition of 44 samples of well water from different parts of Canada are reported and the pollution of wells is briefly discussed.

Water used for irrigation on the station farm, J. A. WIDTSOE (*Utah Sta. Rpt. 1897, pp. 30, 31*).—Analyses are reported which show the mineral constituents in samples of the water used for irrigation in 1892, 1894, and 1895.

Virgin soils of Canada, F. T. SHUTT (*Canada Expt. Farms Rpts. 1896, pp. 184–188*).—Chemical and partial mechanical analyses of 4 soils with corresponding subsoils from different localities in British Columbia are reported, with descriptions of the samples and the regions from which they were obtained and explanation of terms used in reporting soil analyses.

The cultivation of sandy soils in Schleswig-Holstein, TANCRÉ and JORDAN (*Jahrb. Deut. Landw. Gesell., 12 (1897), pp. 196–213*).—A popular article discussing the cultivation and general management of sandy soils.

The cultivation of sea marshes on the coasts of the North Sea, AHSBAHS (*Jahrb. Deut. Landw. Gesell., 12 (1897), pp. 182–196*).—In connection with the article mechanical and chemical analyses of these soils are given.

FERTILIZERS.

Preservation of barnyard manure, F. T. SHUTT (*Canada Expt. Farms. Rpts. 1896, pp. 195, 196*).—As supplementary to the experiments on the deterioration of manure kept for one year in a partially closed shed, an account of which was given in the report of the experimental farms for 1895, p. 42 (E. S. R., 8, p. 880), the author analyzed a sample of the manure collected at the end of the experiment. The fresh manure used weighed 8,000 lbs., the rotted manure obtained weighed 2,659 lbs. Comparing the results of the analysis of the rotted manure with the average composition of fresh manure, the following results were obtained:

Comparison of the composition of fresh and rotted barnyard manure.

	Nitrogen.	Phosphoric acid.	Potash.
	Pounds.	*Pounds.*	*Pounds.*
8,000 lbs. of fresh manure	41.6	24.8	60.8
2,659 lbs. of rotted manure (at end of one year)	23.6	19.5	39.8

In experiments in which finely ground mineral phosphate was mixed with fermenting manure (at the rate of 50 lbs. of phosphate per ton of manure) and kept in glass jars buried in a manure heap from April 29 to August 20 there did not appear to be any "solvent action, or at most a very slight one, on the mineral phosphate exerted by the manure during the process of fermentation."

Is there a constant relation between the solubility of phosphatic slag in ammonium citrate and the weight of the crop produced? A. PETERMANN and J. GRAFTIAU (*Bul. Sta. Agron. Gembloux, 1898, No. 64, pp. 5–13*).—An account is given of pot experiments with 11 different slags on oats followed by white mustard in 1896 and on wheat in 1897. Examinations of the slags used showed that all of them contained more than 16 per cent of total phosphoric acid and 75 per cent of fine meal. The solubility of the phosphoric acid in Wagner's ammonium citrate solution varied from 37 to 93 per cent. The free lime determined by repeated extraction of 5 gms. of slag with 150 cc. of a 20 per cent solution of sugar free from carbon dioxid varied from 0.84 to 5.67 per cent. As the following table of maximums and minimums shows, the citrate solubility varied inversely as the free lime and directly as the silica soluble in mineral acids.

Relation between citrate solubility and free lime and soluble silica in the slags.

	Per cent.	Per cent.
Calcium oxid (free)	5.67 (max.)	0.84 (min.)
Silica soluble in mineral acids	3.24 (min.)	9.27 (max.)
Citrate-soluble phosphoric acid	37.60 (min.)	93.40 (max.)

The variation in citrate solubility is claimed to be due simply to variation in the saturation by the lime of the free citric acid in the reagent. A slag rich in silica is poor in free lime. The citric acid is thus left free to attack the phosphate and a high percentage of citrate solubility is found. A slag poor in silica is rich in free lime and shows a low citrate solubility. This explains why Paturel[1] found that when the acid ammonium citrate was used in excess the citrate solubility of all slags examined was greatly increased, and finally became practically identical.

In the pot experiments with oats, mustard, and wheat, a sandy-clay soil containing 0.65 per cent of phosphoric acid soluble in mineral acids in the cold was used. The results show no constant relation between the citrate solubility and the increase in crop produced or the amount of phosphoric acid utilized by the crop.

General fertilizer experiments, E. H. HESS (*Pennsylvania Sta. Rpt. 1896, pp. 143–156*).—This includes a summary of results obtained during 1895 and 1896 in the combined fertilizer and rotation experiments commenced at the station in 1883 (E. S. R., 8, p. 763), and a record of the relative stand and yield of mixed clover and timothy in these experiments during the same period.

In 1895 the yield of hay was higher than the stand noted in May indicated on the plats receiving nitrate of soda, and lower on those receiving sulphate of ammonia. This is attributed to the season, which was dry up to the middle of June and thus probably more favorable to the action of the nitrate of soda than to that of the sulphate of ammonia. The season of 1896 was also dry and it was observed that the yield was lower than the stand indicated on the plats receiving sulphate of ammonia and higher on those receiving dried blood.

In both years the stand of clover decreased and that of timothy increased as the amount of nitrogen applied increased. "The plats receiving yard manure produced more hay than the stand indicated."

With the exceptions noted, the agreement between the stand and the final yield was fairly close.

Recent researches on reverted phosphoric acid, J. STOKLASA (*Ann. Agron., 23 (1897) No. 12, pp. 588–594*).—Laboratory experiments with salts of known composition led to the conclusion that the water-soluble portion of superphosphates never contains acid ferrous phosphate, this salt changing almost immediately upon its formation into di-tri-ferriphosphates of varying composition insoluble in water. The addition of ferrous salts to soluble phosphates results in the formation of di-tri-ferriphosphates unless an excess of free phosphoric acid is present. Acid ferric phosphate may be found in superphosphates only when there is at least 30 per cent of free phosphoric acid present. If this is not the case, the acid ferric phosphate may be transformed into mono-di-tri-ferriphosphate $Fe_2O_3(P_2O_3)_2.8H_2O$.

[1] Ann. Agron., 22 (1896), p. 497 (E. S. R., 8, p. 681).

It is thus seen that the retrogression of phosphoric acid in superphosphates is very largely dependent upon the free phosphoric acid present. Aluminum salts do not behave like iron salts in superphosphate, but like the salts of lime and magnesia.

Pot experiments with barley on a fertile soil containing 0.63 per cent calcium carbonate and 2 per cent of humus and treated with different phosphates of calcium, aluminum, and iron showed that the effect of the acid phosphates of these elements was almost the same. The tribasic phosphates were about one-half as effective as the acid phosphates. The effect of the normal reverted phosphates was about one-half greater than that of the tribasic phosphates.

These results were obtained with a soil comparatively poor in lime and humus. In a soil containing more than 5 per cent of calcium carbonate, the acid phosphate would be rapidly transformed into tribasic phosphates, while if free phosphoric acid is present it forms normal phosphates.

If the soil contains a large quantity of humus, the reverted phosphates are converted into readily soluble and assimilable forms.

Pot experiments with barley on a soil containing 20.2 per cent of humus and 0.31 per cent of lime showed the reverted phosphoric acid to be in this case almost equal to the water-soluble.[1]

Are the compounds of phosphorus and sulphur found in moors and which are insoluble in strong acids also present in moor plants? M. SCHMOEGER (*Landw. Jahrb., 26 (1897), No. 4–5, pp. 549–554; abs. in Chem. Ztg., 21 (1897), No. 93, Repert., p. 281*).—Determinations were made of the phosphorus and sulphur in moor grasses by treating the fresh and dry plants and the ash of the plants with strong hydrochloric acid. The amounts of phosphoric acid found were: In fresh plants 0.13 per cent, in dry plants 0.228 per cent, in ash 0.267 per cent. Similar results (0.105, 0.212, and 0.243 per cent, respectively) were also obtained by treating the moor soil in the same way, and the author concludes that the difficultly soluble phosphorus compounds of such soils are also present in the plants growing on them. Determinations of sulphuric acid showed a slight increase of this substance soluble in acids on drying, but a decided increase when incinerated.

Fertilizers—barnyard manure and chemical fertilizers, L. CAILLE (*Les engrais; le fumier de ferme et les engrais chimiques. Montpellier: Camille Coulet, 1897, pp. 211, figs. 5*).—This is a popular discussion of the subject from the standpoint of French agriculture. The book is divided into three parts—barnyard manure, chemical fertilizers, and formulas for chemical fertilizers. The third part is of especial interest, because it recommends and explains a series of fertilizer formulas adapted to the principal farm crops. The objections to the recommendation of specific fertilizer formulas are explained, but it is claimed that the use of such formulas is preferable to blind use of factory mixed fertilizers.

In preparing these formulas two classes of soils are taken into consideration—cal-

[1] See also Mitt. Ver. Förd. Landw. Versuchsw. Oesterr., 1893, No. 8, Part II, p. 140 (E. S. R., 5, p. 1015); and Landw. Vers. Stat., 45 (1894), p. 161 (E. S. R., 6, p. 626).

careous and noncalcareous soils. On the former muriate of potash is used as a source of potash and phosphoric acid is used in the form of superphosphate. For the latter sulphate of potash and precipitated phosphate are considered best. The organic forms of nitrogen may be used more freely on calcareous soils than on the noncalcareous soils. In the latter case nitrate of soda and sulphate of ammonia in connection with gypsum are recommended.

Recent investigations on the nitrogen of barnyard manure, E. HASELHOFF (*Landw. Ztg., Westfalen u. Lippe, 55 (1898), Nos. 2, pp. 14–16; 3, pp. 21, 22*).—A brief summary of the conclusions of Wagner, Maercker, Kühn, and others.

Swamp muck and pond muds, F. T. SHUTT (*Canada Expt. Farms Rpts. 1896, pp. 189–195*).—Analyses of 11 samples of muck and 4 samples of pond mud are reported and various suggestions regarding the composting and use of these materials are given.

The utilization of town sewage by irrigation, E. HASELHOFF (*Landw. Ztg., Westfalen u. Lippe, 55 (1898), No. 5, pp. 38–40*).—The amount of phosphoric acid, potash, and nitrogen furnished by sewage and that required by different crops are discussed.

The importance and the utilization of town waste, E. HASELHOFF (*Landw. Ztg., Westfalen u. Lippe, 54 (1897), No. 51, pp. 442–445*).—A popular discussion of the fertilizing value of night soil, sweepings, refuse from slaughterhouses and cattle yards and from flayers' establishments (*abdeckerei*).

Clovers as green manures, F. T. SHUTT (*Canada Expt. Farms Rpts. 1896, pp. 196–200, figs. 4*).—Data relating to the yield and composition of crimson clover, red clover (medium and mammoth), and alfalfa are reported, and notes are given on the assimilation of nitrogen by legumes.

Insuring the action of fertilizers on light soils, VIBRANS (*Jahrb. Deut. Landw. Gesell., 12 (1897), pp. 10–15*).—A popular discussion of this subject.

Utah guano, J. D. WIDTSOE (*Utah Sta. Rpt. 1897, p. 30*).—Analyses are given of 2 samples of Utah guano. It has about the same potash and phosphoric acid content as Peruvian guano, but much less nitrogen.

Analyses of fertilizing materials, F. T. SHUTT (*Canada Expt. Farms Rpts. 1896, pp. 201–207*).—Analyses of 2 samples of wood ashes, 3 of garbage ashes, 1 of bran ashes, 1 of broken oyster shells, and 3 of fish meal are reported, and a compilation of analyses of the principal fertilizing materials is given.

By digesting in 1 per cent citric acid it was found "that 43 per cent of the phosphoric acid and 66 per cent of the potash in maple ashes were brought into solution, and that basswood ashes by this method yielded 22 per cent of their phosphoric acid and 60 per cent of the potash."

Tabulated analyses of commercial fertilizers, T. J. EDGE and W. FREAR (*Pennsylvania Dept. Agr. Bul. 33, pp. 42*).—This bulletin contains the text of the State fertilizer law, notes on valuation of fertilizers, and tabulated analyses and valuations of 603 samples of fertilizers examined during the period from August 1, 1897, to January 1, 1898.

Analyses of miscellaneous fertilizers, J. L. HILLS, B. O. WHITE, and C. H. JONES (*Vermont Sta. Rpt. 1896–'97, pp. 28–30*).—Analyses of 61 samples of fertilizing materials, including home-mixed and factory-mixed fertilizers, acid phosphates, ground bone, nitrate of soda, tankage, muriate and sulphate of potash, wood ashes, limekiln ashes, crematory ashes, cotton waste, and muck are reported. In 11 samples of wood ashes examined the soluble potash varied from 2.45 to 8.21 per cent and the phosphoric acid from 1.08 to 5 per cent.

A product similar to Chile saltpeter from Southwest Africa, H. THOMS (*Jour. Landw., 45 (1897), No. 3–4, pp. 263, 264*).—Analysis of a product found as an efflorescence on stones, especially of overhanging cliffs, and used by the inhabitants in the treatment of a variety of diseases, showed it to be an impure nitrate of soda, the impurities consisting principally of sodium and potassium chlorids, potassium and calcium sulphates, silica, and iron oxid.

The possible injurious effect of perchlorate in nitrate of soda, P. WAGNER (*Jahrb. Deut. Landw. Gesell., 12 (1897), pp. 15–19*).—The danger of using nitrate containing perchlorate, to which Sjollema[1] has called attention, is discussed, and experiments are reported to show that no injury resulted when the amount of perchlorate present did not exceed 0.5 per cent.

On the value of phosphoric acid in superphosphate and in ground Thomas slag, P. WAGNER (*Jahrb. Deut. Landw. Gesell., 12 (1897), pp. 146–150*).—A popular discussion.

What value has the phosphoric acid of bone meal for agriculture? SCHULTZ-LUPITZ ET AL. (*Jahrb. Deut. Landw. Gesell., 12 (1897), pp. 140–146*).—The conclusions of Wagner and Maercker are briefly reviewed, and personal experience is referred to which showed that bone meal is not effective as a source of phosphoric acid on dry, light, sandy soils. It appears to be readily utilized by leguminous plants which are also able in favorable conditions to use crude phosphate to advantage.

Report of experiments with different kinds of crude potash salts, M. MAERCKER (*Jahrb. Deut. Landw. Gesell., 12 (1897), pp. 150–154*).—Experiments with kainit, sylvinite, muriate of potash, carnallite, and other Stassfurt salts on potatoes and barley are briefly reported. Potash in form of chlorid was taken up by the plants more largely than that in form of sulphate. This is ascribed to the greater diffusibility of the chlorid.

A soil test with fertilizers, H. P. ARMSBY (*Pennsylvania Sta. Rpt. 1896, pp. 123–143*).—A reprint of Bulletin 35 of the station (E. S. R., 8, p. 298).

FIELD CROPS.

Results obtained in 1897 from trial plats of grain, fodder corn, and roots, W. SAUNDERS (*Canada Cent. Expt. Farm Bul. 29, p. 40, pl. 1*).—This work was similar to work previously reported (E. S. R., 8, p. 971). Variety tests with oats, barley, spring wheat, peas, corn, turnips, mangel-wurzels, carrots, sugar beets, and potatoes were made at 5 experimental farms located in different parts of the Dominion, and the results are here reported in tabular form. All crossbred varieties which entered into the experiment were produced at the experimental farms. The results of these tests are briefly noted below, the varieties mentioned as most productive being those which gave the largest average results at all the experimental farms.

Oats.—Sixty-three varieties, including 10 crossbred sorts, were sown at the rate of 2 bu. per acre on tenth and twentieth acre plats. Among these, Improved American, Golden Giant, Chevalier O. A. C., Columbus, Mennonite, American Beauty, Early Golden Prolific, Bavarian, Rosedale, Golden Tartarian, Wallis, and Black Beauty, in the order named, produced the largest crops. The average yield for these varieties was 65.29 bu. per acre.

Barley.—Fifteen 2-rowed and 20 6-rowed varieties were tried. The size of the plats and the rate of seeding were the same as in the experiments with oats. The 2-rowed sorts yielding the largest crops were Nepean, French Chevalier, Sidney, Pacer, Canadian Thorpe, and Victor, in the order given. Of these, Nepean, Sidney, Pacer, and Victor

[1] Chem. Ztg., 20 (1896), p. 1002 (E. S. R., 8, p. 762).

are hybrid varieties. The 6 varieties mentioned produced an average of 38 bu. and 27 lbs. per acre.

The varieties of 6-rowed barley which produced the largest average yields at all the experimental farms were Oderbruch, Odessa, Mensury, Rennie Improved, Common, and Petschora, in the order named. The average yield for these varieties was 47 bu. 38 lbs. per acre.

Spring wheat.—Thirty-eight varieties, including 17 crossbred sorts, were tested on tenth and twentieth acre plats, being sown at the rate of 1½ bu. per acre. The largest yields, averaging the results of each variety at all the farms, were obtained from the following varieties, in the order named: Wellman Fife, White Connell, White Fife, Monarch, White Russian, Herisson Bearded, Red Fife, Admiral, Hungarian, Preston, Advance, and Vernon. Of these, Admiral, Preston, Advance, and Vernon are crossbred varieties. The average yield of the 12 varieties was 28 bu. 51 lbs. per acre.

Peas.—Forty varieties were tested: King, Early Britton, Bright, Creeper, Archer, Prince Albert, Crown, Prussian Blue, Centennial, Victory, Vincent, and Alma, in the order named, produced the largest crops. The average for these varieties was 29 bu. 7 lbs. per acre. King, Bright, Archer, Victory, Vincent, and Alma are crossbred varieties.

Corn.—Twenty-four varieties were planted on uniform soil in rows 3 ft. apart, with the plants 6 or 8 in. apart in the row. The yield per acre was calculated from the weight obtained from 2 rows each 66 ft. long. Selected Leeming, Red Cob Ensilage, Cuban Giant, Giant Prolific Ensilage, Mammoth Eight-rowed Flint, and Mammoth Sweet Fodder, in the order mentioned, yielded the heaviest crops. The average yield for these varieties was 21 tons 1,189 lbs. per acre.

Turnips.—Eighteen varieties were under test. Seed was sown "on drills or on the flat." At each farm 2 sowings were made, one 2 weeks later than the other. In general, the early sowings gave the best results. The heaviest crops were obtained from the following varieties in the order given: Prize Winner, Shamrock Purple Top, Halewood Bronze Top, Hartley Bronze, Selected Purple Top, and East Lothian. The average yield for these varieties was 28 tons 1,428 lbs. per acre.

Mangel-wurzels.—During this season 18 varieties were under trial. The crop was grown like the turnip crop, and in this case also the earlier sowings gave the best results. The heaviest crops were obtained from the following varieties in the order mentioned: Giant Yellow, Intermediate, Selected Mammoth, Long Red, Canadian Giant, Gatepost, Champion Yellow Globe, and Prize Mammoth Long Red. The average yield of these varieties was 26 tons 1,229 lbs. per acre.

Carrots.—Fifteen varieties of carrots were grown like the turnips and mangel-wurzels. The larger crops came from the earlier sown plats. The heaviest crops were produced by the following varieties, in the order named: Giant White Vosges, Green Top White Orthe, Yellow Intermediate, Improved Short White, Iverson Champion, Mammoth White Intermediate. The average yield for these varieties was 16 tons 115 lbs. per acre.

Sugar beets.—This crop was grown like the other root crops. As a rule the earlier plantings produced the best results. Out of 5 varieties Red Top Sugar, Improved Imperial, Danish Improved, and Wanzleben, in the order named, produced the heaviest crops. These 4 varieties yielded an average of 16 tons, 217 lbs. per acre.

Potatoes.—Tubers of 98 varieties were cut into pieces with 2 or 3 eyes in each, and planted in rows 26 to 30 in. apart with the sets a foot apart in the row. The yield per acre was calculated from the weight of tubers from 2 rows 66 ft. long. The varieties producing the heaviest yield, taking the average of the results obtained at the experimental farms, as in the case of the other crops, were as follows: Irish Daisy, Clarke No. 1, Seedling No. 7, Northern Spy, Reeves Rose, Lee Favorite, Seedling No. 230, American Wonder, New Variety No. 1, Early Puritan, Brownell Winner, and State of Maine. The average crop of the varieties mentioned was 340 bu. 5 lbs. per acre.

The average yields for the past 3 years of the best yielding varieties of oats, barley, spring wheat, and potatoes are tabulated.

Experiments with corn, J. F. DUGGAR (*Alabama College Sta. Bul. 88, pp. 491–502*).—These were similar to experiments conducted at the station the year previous (E. S. R., 8, p. 881). The results are given in tables, and summarized as follows:

"Seed corn from Illinois gave a smaller general yield than seed corn grown in the South.

"In 1897 the most productive varieties were Mosby Prolific, Cocke Prolific, and Renfro.

"Kernels from the middle portion of the ear failed to show any superiority over seed from the tip or butt end of the ear.

"Topping and also cutting corn and curing it in shocks slightly decreased the yield of grain. The combined value of grain and stocks, valuing the stocks at 25 cts. per 100 lbs., was greater by $2.95 per acre than the value of the grain from the plat where only the ears were harvested.

"When each plant was allowed 15 sq. ft. of space, narrow rows and wide spacing in the drill gave slightly better average results than wide rows and close planting in the drill. Having regard to convenience of cultivation as well as to yield, rows practically 5 ft. apart with plants 3 ft. apart in the drill gave most satisfactory results on poor sandy land.

"Cotton-seed meal alone was the most profitable fertilizer for corn in 1897. Acid phosphate and kainit failed to increase the yield. Cotton seed placed in the ground so late as to germinate had considerable fertilizing value."

Meadows and pasture formation and cultivation in the Middle-Eastern States, J. G. SMITH (*U. S. Dept. Agr., Farmers' Bul. 66, pp. 24, figs. 9*).—This bulletin discusses the commercial value of grasses and their importance as soil builders, describes a number of varieties of grasses and clovers suited for hay and pasture, and outlines the methods of preparing the soil and sowing the seed for the establishment of pastures and meadows.

In considering the grasses as soil builders, the author discusses the function of humus in soil, and infers that a field of turned and rotted turf is in a better condition for cropping than an equal area of long-cropped soil abundantly supplied with commercial fertilizers, but deficient in organic matter. "Turf is indirectly a reservoir of nitrogen, and to cover a field with grass is one of the best ways of increasing the amount of humus in the soil."

Barnyard manure, ground bone, bone meal, fish scrap, tankage, dried blood, bran, cotton-seed meal, peanut meal, and legumes grown as green manures or for soiling purposes, are considered valuable sources of nitrogen in fertilizing grass land. Nitrate of soda is not recommended as a fertilizer for grass lands, because it readily leaches away, often produces bad results when applied in large amounts, and has shown itself to have but little influence on the total amount of nitrogen in a crop of clover or peas. Superphosphate or acid phosphate are recommended as sources of phosphoric acid, and wood ashes, kainit, and tobacco stalks as sources of potash. It is advised to make frequent applications of small amounts of fertilizer on very sandy soils in order to obviate the loss of fertilizing material through washing and leaching. "On such lands, when it can be cheaply obtained, crushed cotton seed, from which the oil has not been extracted, is better than cotton-seed meal, the oil acting to retard the rotting of the seed and thus extending the period of usefulness of its nitrogen."

The preparation of the soil, as outlined by the author, consists of plowing from 6 to 9 in. deep and subsoiling to an additional depth of from 6 to 12 in., and then harrowing the ground until the surface soil has been brought to a fine tilth and all weeds destroyed. Fall seeding is considered most desirable. The author recommends sowing the seed broadcast without a nurse crop, going over the field in two directions, sowing one-half of the seed at each time; to cover the seed with a light brush harrow, and finally to roll the ground for the purpose of packing the surface to prevent the drying out of the young plants.

Timothy, redtop, orchard grass, meadow fescue, tall oat grass, and Italian rye grass are described as hay grasses; and Kentucky blue grass, Canada blue grass, perennial rye grasses, the bent grasses, and red fescue as pasture grasses; white, red, alsike, and crimson clovers, alfalfa, and sandy vetch are described with reference to their value for meadows and pastures. A number of mixtures of seeds for meadows and pastures are suggested.

Farm crops at the experimental farm at Brandon, Manitoba, S. A. BEDFORD (*Canada Expt. Farms Rpts. 1896, pp. 321–347, pl. 1*).—The experiments conducted include variety tests of wheat, oats, barley, corn, peas, grasses, turnips, mangel-wurzels, carrots, sugar beets, and potatoes.

Wheat grown on "back-setting" was quite free from rust, even on low ground, and the grain produced weighed from 60 to 62 lbs. per bu., while on other plats the crop was injured by rust and yielded a lighter grain.

Plats of wheat, oats, and barley sown May 15 and 23 produced better yields than those sown earlier and later; oats and barley when drilled produced a greater yield than when broadcasted. The results of experiments with remedies for smut in oats and barley are tabulated. In every case the treated seed gave the largest yield.

Flax was grown to determine the fitness of the fiber. Sowing 80 lbs. of seed to the acre yielded the largest total crop.

Awnless brome grass (*Bromus inermis*) is discussed at some length and methods of culture are recommended.

Field experiments with small grain and root crops, W. SAUNDERS (*Canada Expt. Farms Rpts. 1896, pp. 5–60, figs. 8, pl. 1*).—The experiments conducted in 1896 comprised variety tests of peas and sugar beets and variety and fertilizer tests with wheat, barley, oats, corn, mangel-wurzels, turnips, carrots, and potatoes. Crops of horse beans, sunflowers, and buckwheat were grown experimentally. The best results from sowing oats, barley, wheat, and peas at different dates were obtained from the sowings made April 27 in each case.

Flax was sown on different dates and at the rate of 40 and 80 lbs. of seed per acre. In 3 out of 4 cases the plats which received 80 lbs. of seed per acre gave the largest quantity of straw, while those which received 40 lbs. yielded the largest crop of seed. The plats sown May 7 produced the greatest weight of straw, and those sown May 14 the largest yield of seed.

The method of originating varieties of crossbred and hybrid grain is discussed, and a table showing the results of vitality tests of grain and other seed is given.

The profitable amount of seed per acre for corn, J. M. BARTLETT (*Maine Sta. Rpt. 1896, pp. 30, 31*).—This is in continuation of work described in the Annual Report of the Station for 1895 (E. S. R., 8, p. 773). The plan of the experiment and the size of the plats were the same as in the previous year. An acre of land was divided into 12 equal plats, which were grouped into 4 sets with 3 plats in a set. The fertilizer applied per acre consisted of 15 two-horse loads of barnyard manure, 250 lbs. of acid South Carolina rock, 100 lbs. nitrate of soda, and 75 lbs. of muriate of potash. Tables show the composition of the crop of 1896 and the yields for each year of the experiment. The results for this season have not changed the relation between the average results for the first 2 years and for the whole period of 3 years. "The average yield per acre of dry matter for the 3 seasons at the several rates of seeding are as follows: Kernels 6 in. apart, 5,699 lbs.; at 9 in., 5,827 lbs.; at 12 in., 5,432 lbs."

The Irish potato, R. H. PRICE (*Texas Sta. Bul. 42, pp. 913–923, fig. 1*).—The work reported here consisted of variety and fertilizer tests and experiments in storing the tubers. Notes on second crop potatoes are given. The soil on which these experiments were conducted is a dark, heavy, sandy clay with an almost impervious subsoil.

A test of 51 varieties, including early, medium early, and late sorts, was made, and the results are given in a table. Each variety is briefly described.

The fertilizer test was made on soil where the previous year the same test with sweet potatoes had been carried on. The largest yield of potatoes was obtained from the application of 300 lbs. of boneblack and 200 lbs. of potassium sulphate per acre. Nitrate of soda in every instance lowered the yield below the average of 3 check plats. These results are identical with those obtained the year before in the fertilizer test with sweet potatoes. Applications of muriate and sulphate of potash proved profitable, and boneblack was found to be the best single fertilizer.

Several methods of storing the tubers were tried with unsatisfactory results. Treating the tubers with Bordeaux mixture or slaked lime, immersing them in a 2 per cent sulphuric acid solution for 15 minutes or an hour, and sprinkling them with lime and sulphur did not satisfactorily prevent decay. Keeping the tubers in barrels in dry sand, covering them 1 ft. deep with soil and giving ventilation, and spreading them out under partial shade and covering them with moist hay about 2 in. deep did not prove satisfactory methods of storing. The best results were obtained by leaving the potatoes in the ground and throwing soil over the rows by means of a plow. By the 1st of September 50 per cent of the tubers had decayed, and during the fall rains many sprouted. Some sound tubers were taken from the rows February 15.

The composition of potatoes, J. A. WIDTSOE (*Utah Sta. Rpt. 1896, pp. 22–25*).—The dry matter and starch of a large number of varieties of potatoes grown in 1894 and 1895 were determined. The results are compared with those reported in Bulletin 5 of the station (E. S. R., 2, p. 664). The composition of the potatoes grown in 1894 and 1895 is shown in the following table:

Composition of potatoes.

	For 1894.		For 1895.	
	Dry matter.	Starch.	Dry matter.	Starch.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Maximum	28.12	22.49	32.47	23.29
Minimum	19.74	13.98	15.44	10.17
Average	23.39	17.85	22.06	16.39

The ripening of sugar beets, J. A. WIDTSOE (*Utah Sta. Rpt. 1896, pp. 25–29*).—From September 22 to November 13, 1896, the amount of total solids and the sugar were determined daily in the juice of sugar beets grown at the station. The average results are shown in the following table:

Average results of sugar-beet analyses.

Date.	Total solids.	Sugar.	Purity.	Mean temperature.
	Per cent.	*Per cent.*	*Per cent.*	*Deg. F.*
September 22	18.1	15.4	84.7	57.8
September 28–October 2	18.4	15.7	85.3	61.4
October 5–9	18.9	15.6	82.3	52.9
October 12–16	19.7	16.2	84.5	53.7
October 19–23	19.1	15.9	84.7	53.9
October 26–30	19.1	16.0	84.0	43.8
November 2–6	18.4	15.5	85.3	34.1
November 9–13	17.8	14.8	83.2	34.1

Variety tests—wheat, oats, and potatoes, E. H. Hess (*Pennsylvania Sta. Rpt. 1896, pp. 157–163*).—Previous work in this line has been reported (E. S. R., 8, pp. 775, 777). The results for this season and the averages for various periods are given in tables. The army worm injured the oats, destroying the value of this season's test, and the results are not reported.

Thirty-one varieties of wheat were grown on thirtieth-acre plats. The best yielding varieties and the number of bushels produced per acre were as follows: Ontario Wonder, 30.57; Fulcaster, 29.81; Wyandotte Red, 27.99; Royal Australian, 27.75; Mediterranean, 27.57; Currell Prolific, 27.56; Jones Square Head, 26.97; Red Fultz, 26.52, and German Emperor, 26.46. The following are the average yields of the first 6 of a number of varieties tested for 7 years: Reliable, 32.21; Fulcaster, 30.75; Ontario Wonder, 30.22; Valley, 29.89; Wyandotte Red, 29.82, and Currell Prolific, 29.66 bu. per acre. For the varieties tested 4 years the average yields for the first 3 were as follows: Royal Australian, 30.56; Canada Wonder, 29.60; Jones Square Head, 29.11 bu.

Among 30 varieties of potatoes Enormous gave the largest yield, 480.8 bu. per acre. Following this variety were Northern Maine, yielding 410 bu.; Delaware, 384.5; Early May, 375.4; Late Puritan, 367.3; Ben Harrison, 363.8, and New Bovee Seedling, 353.1 bu. per acre. The first 6 varieties tested for 3 years stood in the following order: Early Everett, with an average of 267.3 bu.; New Queen, 262.3; Ben Harrison, 259.9; Freeman, 256.9; Pennsylvania Best, 254.3, and Early A, 253.7 bu. per acre.

Report of the agriculturist, D. D. Johnson (*West Virginia Sta. Rpt. 1893, pp. 49–61*).—A report of the work of the station for the year ending May 31, 1893. Cooperative experiments were carried on under the supervision of the station in various parts of the State. The experiments consisted of tests of commercial fertilizers in growing corn, wheat, vegetable crops, and potatoes and variety tests of corn, tomatoes, cabbage, sorghum, pumpkins, and squashes.

Report on the experimental farm for the maritime provinces, G. W. Forrest (*Canada Expt. Farms Rpts. 1896, pp. 297–312*).—This is a report on the meteorological conditions of the year beginning November 22, 1895, and on experiments with spring wheat, barley, oats, peas, turnips, mangel-wurzels, carrots, sugar beets, potatoes, corn, and flax. The greater part of the work consisted of tests of varieties of these different crops. In connection with this early, medium, and late sowings of the grains; fertilizer tests; cultural experiments with corn, and trials of sowing different amounts of flax per acre were made. All results are tabulated.

Farm crops at the experimental farm, Indian Head, Northwest Territories, A. MACKAY (*Canada Expt. Farms Rpts. 1896, pp. 377-403, pl. 1*).—Varieties of wheat, oats, barley, peas, grasses, corn, turnips, mangel-wurzels, carrots, sugar beets, and potatoes were tested. Wheat sown April 13 gave better returns than wheat sown later; drilling 2 in. deep was found to be better than drilling either 1 or 3 in. deep, and among the different amounts of seed sown per acre $1\frac{1}{4}$ bu. gave the largest yield. The cost of growing wheat, oats, and barley at the farm is itemized.

Farm crops at the experimental farm, Agassiz, British Columbia, T. A. SHARPE (*Canada Expt. Farms Rpts. 1896, pp. 425-442*).—Different cereal and root crops were tested. Early sowings of wheat, oats, and barley produced better yields than the late sowings. In the experiments of sowing clover with grain the clover seemed to have lessened the weight of the grain harvested.

New varieties of plants for field culture, A. DUBOIS (*Jour. Agr. Prat., 62 (1898), No. 3, pp. 93, 94, figs. 2*).—Notes on 1 new variety each of beets, potatoes, and maize.

The selection of pasture plants, W. TOOGOOD (*Farmers' Gaz., 56 (1897), No. 52, p. 789*).—A popular article on the methods of establishing pastures.

Methods of establishing meadows, G. HEUZÉ (*Jour. Agr. Prat., 62 (1898), No. 5, pp. 181, 182*).—Notes on the making of meadows. Three different grass mixtures are suggested.

Fodder grasses of the northern hemisphere (*Agr. Jour. Cape of Good Hope, 12 (1898), No. 1, pp. 3-5, fig. 1*).—Notes on Italian rye grass (*Lolium italicum*). The chemical analysis of hay is given, and methods of sowing and harvesting are suggested.

Notes on varieties of vetches, E. QUASTHOFF (*Deut. Landw. Presse, 25 (1898), No. 7, p. 73*).

The velvet bean, E. W. SHANIBARGER (*Florida Farmer and Fruit Grower, n. ser., 10 (1898), No. 4, p. 54*).—A popular article on the velvet bean.

The grass-seed industry in New Zealand (*Farmer's Gaz., 57 (1898), No. 2, p. 17*).

German grass-seed production, WITTMACK and O. ERNST (*Jahrb. Deut. Landw. Gesell., 12 (1897), pp. 164-181*).

Fertilizing constituents in prickly comfrey, F. T. SHUTT (*Canada Expt. Farms Rpts. 1896, p. 201*).—An analysis of this plant, showing the water, organic matter, total ash, and the nitrogen, phosphoric acid, and potash, is reported.

Manuring of potatoes (*Landw. Centbl. Posen, 25 (1897), No. 49, p. 299*).—A popular article.

Sugar cane, W. C. STUBBS (*Baton Rouge: State Bureau Agriculture and Immigration, 1897, vol. 1, pp. 208, figs. 28*).—This is the first volume of a treatise on the history, botany, and agriculture of sugar cane, and the chemistry and manufacture of its juices into sugar and other products. This volume treats of the history, botany, and agriculture of the plant.

Sugar-beet experiments in Arizona, R. H. FORBES (*Arizona Sta. Bul. 26, pp. 15*).—This is a report on cooperative experiments with sugar beets in 1897. In most cases the Kleinwanzlebener and Vilmorin varieties were grown. The former were richer in sugar content and showed a higher coefficient of purity than the latter. Beets grown after alfalfa gave better results as to richness and purity than those grown on a virgin soil.

The breeding of grains in Russia (*Mitt. Deut. Landw. Gesell., 1898, No. 3, Sup., pp. 17-19*).

The growing of malting barley (*Queensland Agr. Jour., 1 (1897), No. 6, pp. 433, 434*).—Hints on harvesting the crop.

Results of experiments with cereals, F. MADDOX (*Notes and Results on Agricultural Experiments, Tasmania, 1897, pp. 1-71, figs. 96*).—The work reported here consisted mainly of culture and fertilizer experiments and variety tests with wheat carried on for a number of years. Analyses of cereal, root, and forage crops are given.

The effect of nitrogen of cow, horse, and sheep manure in a cultural experiment with oats, G. RUDORF (*Fühling's Landw. Ztg., 47 (1898), No. 2, p. 58*).—An article discussing the results obtained in fertilizer experiments by Wagner, Maercker, Kühn, and other investigators.

The grading of wheats, N. A. COBB (*Agr. Gaz. New South Wales, 8 (1897), No. 12, pp. 855–859, pls. 6*).—Twenty-eight varieties of wheat were graded into 7 grades by means of sieves with meshes varying from 2 to 3.25 mm. The work of grading is described and the value of the results pointed out. The variety Algerian ranked first in percentage of large grains.

Comparative variety test of summer wheat (*Jahresber. Agr. Bot. Vers. Stat. u. Samenprüf. Anstalt, Hamburg, 8 (1898), pp. 8, 9*).—A report on 6 varieties. Beseler verbesserter Kolbenweizen gave the best yield. Noe produced the heaviest grain, having also been grown from the heaviest seed. The average number of spikelets in the head was greatest for this variety.

Judging of the milling qualities of prize wheats at shows, etc., F. B. GUTHRIE and E. H. GURNEY (*Agr. Gaz. New South Wales, 8 (1897), No. 12, pp. 860–865*).—The authors recommend the determination of (1) appearance, (2) weight per bushel, (3) ease of milling, (4) percentage of flour obtained, (5) color of flour, (6) percentage of gluten in flour, (7) strength of flour (in quarts of water per sack of 200 lbs. flour). They report the examination of a number of samples of wheat by this method.

Concerning the conditions under which the volume weight of wheat furnishes a means of judging of its quality, F. SCHINDLER (*Jour. Landw., 45 (1897), No. 1, pp. 61–78*).

Distribution of grain, potatoes, forest trees, etc., A. MACKAY (*Canada Expt. Farms Rpts. 1896, pp. 419–421*).—The distributions made in the provinces of Assiniboia, Alberta, and Saskatchewan are tabulated.

HORTICULTURE.

Orchard notes, W. M. MUNSON (*Maine Sta. Rpt. 1896, pp. 64–83*).—A statement of the condition of the orchard at the station is given. No conclusions are drawn, the statement being merely preparatory to a future report. Notes are given on the condition of 57 varieties of plums. The most promising varieties are Duane Purple, German Prune, Hudson River Purple Egg, Imperial Gage, Lombard, McLaughlin, Pond Seedling, Smith Orleans, and Washington. A table is given showing the condition and growth of 34 varieties of apples in 1896, the habit of the trees, and their age at first fruiting. Notes are given on 9 of the less common of these varieties. Notes are also given on 54 varieties of Russian apples, of which the following are considered most promising: Aport, Arabskoe, Golden Reinette, Hibernal, Lead Apple, Longfield, Russian Gravenstein, and Vargulek. The behavior of a number of varieties of Russian apples grown in Aroostook County, Maine, is recorded in tables and brief notes.

The cherry in Delaware, G. H. POWELL (*Delaware Sta. Bul. 35, pp. 23, figs. 9*).—This is a popular bulletin treating of the extent of the cherry industry in Delaware, the classification of the cherry, and such practical considerations as soil, location, propagation, planting, cultivation, handling the crop, profits, varieties, diseases, and injurious insects. The fruit of a number of varieties of cherries is illustrated.

Cherry culture in Delaware is limited to dooryards and gardens, but the author believes that it could be profitably extended. The sour cherries succeed in all parts of Delaware, but the sweet cherries can be grown profitably only in a small portion of the State. Brown rot is the most destructive fungus disease and the black aphis and curculio are the worst insect enemies. The author believes that sun scald and bursting of the bark are favored by nitrogenous fertilizers, late fall growth, and exposed trunks. He therefore recommends the use of trees with low spreading heads, the selection of soils that do not favor too vigorous wood growth, and the adoption of such cultural methods as tend to early maturity of wood.

Winter protection of the peach, J. C. Whitten (*Missouri Sta. Bul. 38, pp. 140–159, figs. 5*).—Winterkilling of the fruit buds of the peach is a very serious drawback to peach culture in the State. In regard to the causes of winterkilling, the author believes that other conditions than mere cold weather are often responsible, since peaches frequently withstand a temperature of —10 to 25° F. with little injury. Trees are made more susceptible to injury from cold by imperfect ripening of the wood and buds, due to a late autumn growth induced by warm weather and rains following the dry weather of August. Sudden changes of temperature, either freezing or thawing, is considered more injurious than gradual changes. The most common cause of winterkilling of peaches in the State is the growth of buds during warm weather in winter, which renders them very susceptible to injury from subsequent freezing. The peach is easily stimulated into growth by the warm weather, which often occurs as early as February.

Various means of protecting peach buds from winterkilling have been tried at the station. Of these the effect of whitening the trees and buds has received most attention. In the winter of 1895–'96, a row of young trees running diagonally across the orchard and 4 older trees were sprayed with lime whitewash. The winter was remarkable for its changeable temperatures. During warm periods the unwhitened buds grew perceptibly before any swelling could be detected in the whitened buds. Longitudinal sections of whitened and unwhitened buds taken March 20 showed that in all cases the unwhitened buds had made considerable more growth than whitened ones and that in many cases their pistils were injured. Whitened trees bloomed about one day later than the unwhitened ones. It is thought that the difference in time of blossoming was much less than it would have been in a normal season; the weather became suddenly warm with a dry wind at blossoming time, forcing all varieties into bloom at nearly the same time. Only 20 per cent of the flowers that opened on the unwhitened trees were uninjured and only a few of these set fruit. On the whitened trees 80 per cent of the flowers were perfect and more fruit set than on the unwhitened trees.

In the winter of 1896–'97 the same trees were again whitened. A number of illustrations are given of both whitened and unwhitened twigs, showing the condition of the buds at various times during the winter and spring. Early in March buds of unwhitened trees were perceptibly swollen, while whitened ones were still dormant. In the middle and last of March the unwhitened buds were much more swollen than the whitened ones. Early in April the unwhitened ones were nearly ready to open, while the others were much less advanced. The unwhitened buds opened from 2 to 6 days earlier than the others. Rivers Early peaches set very abundantly and about equally on whitened and unwhitened trees. Whitened trees of Heath Cling, Silver Medal, and Wonderful varieties set more fruit than the unwhitened ones.

At first a common lime whitewash was used, but it washed off badly in rainy weather. A whitewash of lime with one-fifth skim milk added to the water and 1 lb. of salt per bucketful proved more satisfactory. The whitewash was applied with a spray pump. Four sprayings during winter and spring were sufficient, 2 sprayings being given to begin with to insure a thorough whitening. About half a bucketful of whitewash was used per tree at each spraying. The author states that the entire expense of the 4 sprayings need not exceed 10 cts. per tree. A note is given on the use of copper sulphate applied with the whitewash as a fungicide.

In order to study the relative absorption of heat by the different colors, 4 dairy thermometers, having their bulbs wrapped in green, purple, black, and white muslin, and 1 theremometer with its bulb naked, were exposed to the sun, being hung about 5 ft. from the ground in the orchard. Readings were taken at various times in bright sunshine during February. The thermometers were then removed to the south side of the building, their wrappings removed and placed over them, forming a screen 1 ft. square. Readings were taken during bright weather in the latter part of March. The temperatures recorded are given in tables. The darker the color of the cloth the higher the temperature reached.

In April readings were taken with 4 standard thermometers hung in the open air. The bulbs and such portions of the tubes as could be covered without hindering the taking of readings were coated with whitewash. For 3 of the thermometers the whitewash was colored with anilin dyes; in one case green, in one purple, and in one black. A table is given showing the readings taken. The darker colors absorbed much more heat than the lighter ones. A difference in temperature of 10 to 15° was frequently shown between the white and the purple bulbs, and once in very bright sunshine the difference ran as high as 21°. This difference shows how whitening the green and purple twigs of peaches tends to keep them dormant during warm days of winter.

In the winter of 1895–'96 a few peach trees were protected by drawing the limbs together with a rope, covering them with cornstalks, and binding the whole into a bundle. About 80 per cent of the fruit buds thus protected were uninjured, while only about 20 per cent of the unprotected buds came through the winter without injury. The covered trees blossomed 2 days later and remained in bloom several days longer than the others. Some of the trees were uncovered at blossoming time and others later, one tree being left until nearly 3 weeks after blossoming. Fruit had set well under the cover except near the top, where the limbs were bound closely together. With young trees the protection is about as easily and cheaply applied and about as effective as whitening, but can not be used as readily with old trees.

Shading 4 trees with canvas hay caps proved about as effective as whitening or covering with cornstalks. For young trees the expense is about equal to whitening, but for old trees the canvas would be too expensive.

Covering the trees with board sheds was tried during 2 winters. Posts were set at the outer ends of the branches, rafters placed on them to meet over the center of the tree, and fence boards fastened an inch a part on the top and part way down the sides. These sheds furnished by far the most effective protection to the trees. Trees thus protected set fruit very well in the spring of 1896 and were not severely injured by either the cold of winter or the hot, dry winds of spring. In the spring of 1897 the buds did not start until the normal blossoming time, the trees blossoming 4 to 5 days later than unprotected trees and 1 day later than whitened ones. They remained in blossom longer and set much more fruit than any other trees of the same varieties in the orchard. The sheds were left over the trees until the middle of May. Almost no fruit dropped from the protected trees, while a good deal dropped from the unprotected ones. Though this method was the most effective one tried, it is considered too expensive for use except in rare instances. The cost for lumber was about $2 per tree and the cost of building and taking down the sheds 80 cts., making the cost about $1 per tree each year.

The cultivation and management of the peach, J. C. WHITTEN (*Missouri Sta. Bul. 38, pp. 159–164*).—Notes are given on location, fertilizers, soil, planting, cultivation, pruning, thinning fruit, spraying, varieties, etc., the directions given being based on experiments at the station and observations throughout the State. The author recommends the following varieties, named in the order of ripening: Southern Early, Mountain Rose, St. John, Reeves Favorite, Champion, Family Favorite, Foster, Elberta, Mrs. Brett, Wheatland, Oldmixon Free, Oldmixon Cling, Gaylord, Crawford Late, Stump, Smock, Piquette Late, and Salway.

Problems in plum pollination, F. A. WAUGH (*Vermont Sta. Rpt. 1896–'97, pp. 87–98, 124–133, figs. 6*).—This is a continuation of work reported in Bulletin 53 of the station (E. S. R., 8, p. 598).

Self-sterility (pp. 87–89, 124–125).—In 1897 a large number of blossoms of 56 varieties of various classes of plums in orchards at Denton, Maryland, were protected from cross-pollination by inclosing them in paper sacks. A table is given, showing for each variety the number of blossoms covered, the number of fruits produced from covered blossoms, and the setting of fruits from unprotected blossoms. The following is a summary of the results:

Record of protected blossoms.

Groups.	Varieties included.	Blossoms covered.	Fruit set.
Japanese	3	478	0
Americana	18	1,709	1
Nigra	2	188	0
Miner	5	462	1
Wayland	6	856	1
Wild Goose	11	1,316	0
Chicasaw	11	1,419	2
Total	56	6,428	5

The author believes that these results indicate the self-sterility of all classes and varieties of native plums and of some Japanese plums.

Natural adaptations for cross-pollination (pp. 89–91, 126–133).—Of the various modifications of flowers by which self-pollination is rendered more difficult, those found most common in case of plums are defective pistils, long styles, and proterogyny. A table is given showing the frequency of these modifications in case of a large number of varieties of the different groups of plums in various localities during the past 2 years. The average percentages of defective pistils in the various groups of plums were as follows: Domestica group, 4.3 per cent; Japanese, 11.2; Americana, 21.2; Nigra, 17; Miner, 1.9; Wayland, 10.5; Wild Goose, 19.8; Chicasaw, 10.5; Hybrids, 18.1. The author considers defective pistils to be dependent upon the physiological character of the plant, variety, or species, on the age and health of the tree, and on the storage of food materials. The effect of the health of the tree on the percentage of defective pistils was well shown with Burbank plum, the pistils of a healthy tree being 2 per cent defective, and of a tree dying from the effect of brown rot fungus 58 per cent defective. As to the storage of food materials the author says: "Repeated observations have shown that buds so situated upon a branch as to command a relatively large storage of food give, as a rule, large blossoms, large ovaries, and perfect pistils; while other buds less favorably situated on the same twigs develop sickly looking blossoms with pistils weak or wanting. Any condition of an entire tree which prevents the normal storage of food materials in buds and branches is likely to show in defective pistils at the next blossoming season." A tree of Wolf Seedling No. 4, which bore much too large a crop in 1896, had not a perfect blossom in 1897.

Pollination affinities of varieties and species (pp. 91, 92).—A number of crossing experiments were made to determine what varieties are best adapted to pollinate certain other varieties, but the results are considered by the author to be too meager and contradictory to justify conclusions.

Blossoming seasons of plums (pp. 92–98).—The time of blossoming and duration of blossoming period of 176 varieties of plums is shown in a chart, the varieties being arranged in the order of their time of blossoming. The chart represents the average blossoming season in the latitude of Denton, Maryland, observations made in orchards there being taken as a basis for the chart, and supplemented by data secured from orchards representing all sections of North America. The duration of the blossoming season of plums is 4 or 5 weeks in the extreme south, and becomes gradually less northward, being but 9 or 10 days in northern Vermont. The average duration for each variety varies from 5 or 6 days in the extreme south to 2 or 3 days in the extreme north. Given varieties do not always blossom in the same order in different localities, or even in different seasons in the same locality. The author believes, however, that these variations are not common enough to affect seriously the reliability of the general averages. The date of blossoming of 8 varieties of plums at Denison, Texas, and Ottawa, Ontario, in 1896 and in 1897 are tabulated, to show the extremes of the blossoming periods in America.

Classification of plums, F. A. WAUGH (*Vermont Sta. Rpt. 1896–'97, pp. 98–106*).—The classification presented in this article gives the opinion of the author and J. W. Kerr, of Denton, Maryland, on the relationships of the cultivated varieties of plums. The following groups are recognized: Domestica (*Prunus domestica*), Japanese (*P. triflora*), Americana (*P. americana*), Nigra (*P. americana nigra*), Miner (*P. hortulana*), Wayland (*P. hortulana*), Wild Goose (*P. hortulana*), Chicasaw (*P. angustifolia*), and Marianna (probably hybrids). The affinities of these groups are discussed and the varieties referred to each group are noted.

The preservation of fruits by vapor of alcohol, F. A. WAUGH (*Vermont Sta. Rpt. 1896–'97, pp. 111–116*).—A number of experiments in keeping various fruits are reported. In addition to tests with alcohol, dilute formalin and "platinum waste recovery fluid" were used in one case. The results were mostly negative. The author concludes that vapor of alcohol in a closed space will prevent more or less the growth of fungi and bacteria which usually cause decay but to be effective it must be present in considerable quantities, in which case the fruits, especially those with soft flesh, absorb enough alcohol to render them very disagreeable to the taste. The fruit deteriorates in color and texture and processes of decay other than those due to fungi and bacteria seem to be hastened. The method seems best adapted to keeping grapes but may be of some value for preserving other fruits, as strawberries and raspberries, for a very short time.

Report of the horticulturist of the experimental farm for the Maritime Provinces, W. S. BLAIR (*Canada Expt. Farms Rpts. 1896, pp. 313–319*).—Brief notes are given on a number of fruits, vegetables, and ornamental plants. In most cases the notes are accompanied by lists of varieties which are considered most desirable.

Coffee culture in the Hawaiian Islands, W. HAYWOOD (*U. S. Consular Rpts., 1898, No. 209, pp. 139–164*).

Planting camphor seed, E. RUMLEY (*Florida Farmer and Fruit Grower, 10 (1898), No. 4, p. 51*).—Popular directions for germinating camphor seed, and subsequent transplanting.

Asparagus culture, P. GHERVIN (*Bul. Dir. Agr. et Com., 3 (1898), No. 6, pp. 57-62*).

Cabbages, H. P. GOULD (*Maine Sta. Rpt. 1896, pp. 145-150*).—Reprint of Bulletin 24 of the station (E. S. R., 8, p. 48).

Growing celery in beds, J. CRAIG (*Canada Expt. Farms Rpts. 1896, p. 178*).—A brief note on the relative merits of beds and rows for growing celery on a small scale. A tabular statement of the yield of 8 varieties of celery grown in beds is given.

Lettuce forcing, W. BRENNECKE (*Amer. Gard., 19 (1898), No. 161, Sup., p. 1*).—A prize essay on the forcing of lettuce.

Lettuce forcing, D. S. LINCOLN (*Amer. Gard., 19 (1898), No. 161, Sup., p. 2*).—A prize essay.

The essentials of lettuce forcing; subirrigation, W. STUART (*Amer. Gard., 19 (1898), No. 161, Sup., pp. 4-6*).

Various systems of lettuce forcing, P. H. DORSETT (*Amer. Gard., 19 (1898), No. 161, Sup., pp. 3, 4, figs. 3*).

New melons (*Wiener Illus. Gart. Ztg., 22 (1898), No. 1, pp. 28-30, figs. 4*).—Descriptive notes and illustrations of 4 new melons.

Mushroom culture in France, C. REPIN (*Garden, 53 (1898), No. 1368, pp. 99-105, figs. 6*).—A reprint from Revue Générale des Sciences.

Reference list of publications relating to edible and poisonous mushrooms, JOSEPHINE A. CLARK (*U. S. Dept. Agr., Library Bul. 20, pp. 16*).—The list contains references to some 300 publications.

Garden peas, T. A. SHARPE (*Canada Expt. Farms Rpts. 1896, pp. 175-177, 442, 443*).—Variety tests of 16 varieties of peas at the experimental farm for British Columbia and 101 varieties at the central farm.

Peas and sweet corn, H. P. GOULD (*Maine Sta. Rpt. 1896, pp. 154-158*).—Reprint of Bulletin 27 of the station (E. S. R., 9, p. 231).

Notes on winter gardening, W. M. MUNSON (*Maine Sta. Rpt. 1896, pp. 84-108, pls. 2, figs. 5*).—This is a popular article dealing with construction and management of cold frames, hotbeds, and forcing houses; methods of heating, watering, etc.; and forcing of lettuce, tomatoes, cucumbers, radishes, beans, asparagus, and rhubarb.

Vegetables, flowers, and fruits, A. MACKAY (*Canada Expt. Farms Rpts. 1896, pp. 403-413*).—A report of variety tests of a considerable number of varieties of vegetables, fruits, and flowers at the experimental farm for the Northwest Territories.

Experiments with fruits, vegetables, and ornamental and forest trees, S. A. BEDFORD (*Canada Expt. Farms Rpts. 1896, pp. 352-373*).—This is a report of extensive variety tests at the experimental farm for Manitoba. The data are given in tables and brief notes.

Keeping qualities of apples, J. CRAIG (*Canada Expt. Farms Rpts. 1896, p. 146*).—A number of varieties of apples packed in boxes or baskets were kept in a dark cellar having a temperature of 35 to 40° F. during January, February, and March, and of 45° F. and greater in April and May. For a short time in January the temperature of the cellar was 26° F. and the apples were frozen. In the latter part of May the percentages of sound fruit of the various varieties were as follows: Ben Davis 100, Orange 93, Wagener, 88, Ralls Genet 82, Wine Sap 82, Walbridge 73, Green Sweet 72, Crimean 62, Lawver 49, Bombarger 44, Duke of Connaught 42, Hardy 34, Swayzie 31, Pewaukee 20, Watterson No. 3 20, Salome 20, Fameuse 12, Quaker Beauty 4, and Hardisty, Haas, Gideon, McIntosh Red, and Anisovka 0.

Varieties of apples, J. CRAIG (*Canada Expt. Farms Rpts. 1896, pp. 125-135, figs. 6*).—Notes on a number of varieties.

Evaporating apples, J. CRAIG (*Canada Expt. Farms Rpts. 1896, pp. 160-163*).—Data as to the relative merits of different varieties of apples for evaporating.

Improvement of the sand cherry, Prunus pumila, J. CRAIG (*Canada Expt. Farms Rpts. 1896, pp. 123, 124, figs. 2*).—A brief note.

Olive culture in California, H. G. TINSLEY (*Bul. Dir. Agr. et Com., 12 (1897), No. 5, pp. 297–301*).

Relative hardiness of fruit buds of peaches and plums, J. CRAIG (*Canada Expt. Farms Rpts. 1896, pp. 153–158*).—The results of an investigation to ascertain the relative amount of winter injury sustained by various varieties of peaches and plums throughout Ontario are given, together with a brief discussion of the effect of frost on vegetable tissue. A preliminary and tentative grouping of the varieties according to the hardiness of their fruit buds is given.

Pears, plums, and cherries, J. CRAIG (*Canada Expt. Farms Rpts. 1896, pp. 135–141*).—Tables are given showing the varieties of pears, plums, and cherries planted at the central experimental farm since 1888; the varieties living, the varieties dead, and the causes of their death.

The peach industry in Pennsylvania, G. C. BUTZ (*Pennsylvania Sta. Rpt. 1896, pp. 85–111, pls. 2, figs. 14*).—A reprint of Bulletin 37 of the station (E. S. R., 9, p. 351).

Report on fruits at Huntington, E. A. BENNETT (*West Virginia Sta. Rpt. 1893, pp. 19–21*).—Notes on apples, cherries, grapes, Russian fruits, and pecans.

Fruit notes, T. A. SHARPE (*Canada Expt. Farms Rpts. 1896, pp. 443–458*).—Descriptive notes are given on a large number of varieties of the various fruits grown at the experimental farm for British Columbia.

Seedling fruits, J. CRAIG (*Canada Expt. Farms Rpts. 1896, pp. 141–146*).—Information regarding 31 varieties of seedling apples, 6 of plums, 2 of peaches, and 1 each of gooseberries and currants. A number of the more promising seedlings are given a more extended description.

Pruning deciduous fruit trees, T. H. RAMSAY (*Pacific Tree and Vine, 14 (1898), No. 47, pp. 138, 139*).

A new grafting machine, F. A. WAUGH (*Vermont Sta. Rpt. 1896–'97, pp. 122, 123, fig. 1*).—A test of a new grafting device invented in France is reported.

Root killing of fruit trees, J. CRAIG (*Canada Expt. Farms Rpts. 1896, pp. 147–153*).—A discussion of the use of hardy stocks and cover crops to prevent winter killing of the roots of trees and a record of results obtained with various stocks and cover crops. Mammoth clover gave the best results as a cover crop. Alfalfa and crimson clover were next best. Cowpeas and soy beans were of little use.

Mulching to retard blossoming of large and small fruits, J. CRAIG (*Canada Expt. Farms Rpts. 1896, pp. 158–160, figs. 2*).—Apples, cherries, plums, gooseberries, currants, and strawberries of various varieties were mulched with strawy manure about March 15, when the ground was deeply frozen and covered with 8 to 12 in. of snow. Others of the same varieties were left unmulched for comparison. A table is given comparing the time of leafing and blossoming of the mulched and unmulched plants. The mulch did not retard leafing and blossoming, except in the case of the strawberries, the tops of which were of course covered. The author concludes that keeping the roots frozen does not affect the time of leafing and blossoming of plants whose tops are unprotected.

Experiments in cross-fertilizing to produce fruits suitable for the Canadian Northwest, W. SAUNDERS (*Canada Expt. Farms Rpts. 1896, pp. 61–66, figs. 4*).—Notes on the progress of work in originating hardy varieties of fruits.

Cranberries, J. CRAIG (*Canada Expt. Farms Rpts. 1896, pp. 120–122, fig. 2*).—Notes on cranberries and cranberry culture in Canada.

Raspberries, J. CRAIG (*Canada Expt. Farms Rpts. 1896, pp. 118, 119, fig. 1*).—An experiment with 17 varieties of red raspberries is reported. Plants that were given winter protection by covering with soil were less injured by winterkilling and yielded more than unprotected plants. Summer pruning, pinching back when 15 to 20 in. high, decreased the yield.

The grape, J. CRAIG (*Canada Expt. Farms Rpts. 1896, pp. 103–118, figs. 3*).—Notes on the botanical characters, propagation, cultivation, pruning, training, and varieties of grapes, with tabular data regarding 167 varieties grown at the central experimental farm.

Practical advice in regard to hybridizing grapes, P. CASTEL (*Prog. Agr. et Vit., 29 (1898), No. 5, pp. 137–147, figs. 9*).—This is one of a series of articles on hybridizing grapes, the present article treating of the saving, care, and sowing of the seeds. In the course of the paper the author notes some observations on the immediate effect of cross-pollination. Pollen from various sources had no immediate effect on the color or form of the fruits resulting from its use. The seeds of these fruits, on the other hand, were greatly modified in form and resembled the seeds of the varieties which furnished the pollen for crossing. Flowers of the Herbemonts d'Aurelle grape crossed with pollen from the Othello, Alicante-Bouschet, and varieties of *Vitis riparia* and *V. rupestris*, produced seeds which so resembled those of the varieties from which the pollen was taken that the latter could be readily determined by an inspection of the seeds.

New stocks for calcareous soils, P. GERVAIS (*Prog. Agr. et Vit., 29 (1898), No. 5, pp. 132–136*).—Notes on some hybrid grapes used on calcareous soils as stocks for grafting.

Nut culture, F. M. BARTRAM (*New England Florist, 3 (1898), No. 49, pp. 547, 548*).—Extracts from a paper given before the Massachusetts Horticultural Society.

Chestnut culture for fruit, W. A. BUCKHOUT (*Pennsylvania Sta. Rpt. 1896, pp. 111–121, pls. 2*).—A reprint of Bulletin 36 of the station (E. S. R., 8, p. 497).

Ornamental asters, H. DAUTHENAY (*Rev. Hort., 70 (1898), No. 2, pp. 30–33, figs. 10*).—Notes and illustrations of a number of species and varieties.

Some flowering cherries (*Garden, 53 (1898), No. 1367, p. 81, figs. 4*).

Directions for the culture of large-flowered chrysanthemums, V. VIVIAND-MOREL (*Paris: Doin, 2. ed., pp. 48*).—In this edition a chapter on hybridizing chrysanthemums has been added.

Hymenocallis and pancratium (*Garden, 53 (1898), No. 1366, pp. 57, 58, fig. 1*).—Descriptive notes on a number of species of these plants.

Notes on irises, W. SAUNDERS (*Canada Expt. Farms Rpts. 1896, pp. 67–69, figs. 5*).

The Italian, or orchid-flowering, cannas, F. A. WAUGH (*Vermont Sta. Rpt. 1896–'97, pp. 119–122, figs. 3*).—A discussion of the origin of these cannas, with a note on their behavior at the station.

Culture of Phyllocactus (*Monatsschr. Kakteenkunde, 8 (1898), No. 1, pp. 2–5*).

FORESTRY.

The timber pines of the southern United States, C. MOHR (*U. S. Dept. Agr., Division of Forestry Bul. 13, pp. 176, pls. 20, figs. 12*).—This is a revised edition of this bulletin (E. S. R., 8, p. 602), and contains, in addition to changes in the text, notes by F. Roth which supplement the previous studies on the southern pines. In addition a short sketch is given by the same author on the pond pine (*Pinus serotina*). This pine, which, when young, is not easily distinguished from the Loblolly pine, is in some places cut and sold indiscriminately with it, and furnishes from 10 to 15 per cent of the lumber known in the market as North Carolina pine. The growing scarcity of the long-leafed pine has resulted in bleeding this pine for turpentine, the yield of which is fair both in quantity and quality. When its ready reproduction, rapid growth, and ability to occupy poorly drained and otherwise almost worthless land are considered, the pond pine deserves consideration in all future forest operations in its region.

Forest trees, A. MACKAY (*Canada Expt. Farms Rpts. 1896, pp. 413–416*).—A report is given on the present condition of the shrubs and trees in the arboretum, and also the cost of planting and taking care of trees for the first and second years. In 1895 7 half-acre plats were planted with trees at different distances apart for the purpose of ascertaining the cost of planting and keeping them clean and in a thriving condition until the trees had grown sufficiently to need no further cultivation. In 4 plats box elders were planted, in 2 plats green ash, and in 1 plat box-elder seed was sown in rows. The rows were separated $2\frac{1}{2}$, 3, and $3\frac{1}{2}$ ft. The cost of planting and cultivating is shown in tables, in which it appears that the expense of planting and taking care of trees the first and second years varies from $9.58 to $12 per acre.

The United States Forest Reserves, C. D. WALCOTT (*Pop. Sci. Mo., 52 (1898), No. 4, p. 456*).—Discusses the general features of forest reserves and gives their present extent and location.

The forest department of the Biltmore Estate, North Carolina (*Forester, 4 (1898), No. 2, pp. 37–39*).—Describes the Biltmore and Pisgah forests.

The twenty-fifth annual meeting of the German Foresters (*Forstw. Centbl., 20 (1898), No. 2, pp. 82–96*).—An account is given of the meeting held at Stuttgart, August 30–September 3, 1897.

Forestry in Roumania (*Ztschr. Forst u. Jagdw., 30 (1898), No. 1, pp. 33–43*).

The native forest trees of Nebraska, C. E. BESSEY (*Nebraska State Bd. Hort. Rpt. 1897, pp. 3–38*).—The 67 trees indigenous to the State are listed and their range indicated. The most of the species have entered the State from the southeast along the valley of the Missouri River, only a few having come down from the high mountains to the west.

Forest trees in Nebraska, P. YOUNGERS (*Nebraska State Bd. Hort. Rpt. 1897, pp. 9–22*).—The general conditions of forestry and some of the difficulties of forest tree culture are given. Notes are also given of the species of trees best adapted to the soils and climate of the State.

What has the timber-claim law done for Nebraska? E. F. STEPHENS (*Nebraska State Bd. Hort. Rpt. 1897, pp. 51, 52*).—The author states that about 4,000,000 acres were taken up under that law and more than 500,000,000 trees were planted. The beneficial effects of this planting are shown and the statement made that these plantings were spreading.

Partial abstract of timber cut during the year 1896 in Pennsylvania, J. T. ROTHROCK (*Pennsylvania Dept. Agr. Rpt. 1896, pp. 407–409*).—The report shows that there were 140,150 acres of woodland cut over, yielding 1,330,425,908 ft. of timber, board measure, and 486,389 cords of bark.

Forest value of trees as determined by timber tests, H. MAYR (*Forstw. Centbl., 20 (1898), No. 2, pp. 72–82*).

Losses by forest fires in Pennsylvania during 1896, J. T. ROTHROCK (*Pennsylvania Dept. Agr. Rpt. 1896, pp. 416, 417*).—From partial reports the author estimates the actual money value of timber destroyed by fires at $557,056.

Forest destruction and stream flow in southern California, A. KINNEY (*Forester, 4 (1898), No. 2, pp. 41, 42*).—Notes the destruction caused by the rapid running off of water from the Soledad watershed after the forest growth had been destroyed.

Relation of forests to the farmer, J. T. ROTHROCK (*Pennsylvania Dept. Agr. Rpt.*

1896, pp. 382–396).—Discusses the origin and value of forests, their importance, and how they may be restored.

Forestry for farmers, B. E. FERNOW (*U. S. Dept. Agr., Farmers' Bul. 67, pp. 48, figs. 15*).—This is a reprint from the Yearbooks of this Department for 1894 and 1895 (E. S. R., 7, p. 508; 8, p. 794).

Care of woodlands, W. H. BUCKHOUT (*Pennsylvania Sta. Rpt. 1896, pp. 122, 123*).—Notes are given on the care of oak woodlands by which they may be made more productive.

Forest conservation, A. J. BOYD (*Queensland Agr. Jour., 1 (1897), No. 6, pp. 478–482*).

Sheep grazing in forest reserves, F. V. COVILLE (*Forester, 4 (1898), No. 2, pp. 30–32*).

American oaks in Campine (*Bul. Soc. Cent. Forst. Belg., 5 (1898), No. 1, pp. 45–60*).—Notes are given on *Quercus rubra*, *Q. palustris*, *Q. tinctoria*, *Q. coccinea*, *Q. phellos*, and *Q. imbricaria*.

Culture of pines in the Main-Rhine Valley (*Forstw. Centbl., 20 (1898), No. 2, pp. 66–72*).

On the growth of the buds of Pinus sylvestris, E. BERGER (*Bul. Soc. Cent. Forst. Belg., 5 (1898), No. 1, pp. 26–36*).

On the collection of forest tree seed, E. PARISEL (*Bul. Soc. Cent. Forst. Belg., 5 (1898), No. 1, pp. 13–26*).

On the effect of lime rings on the health of fir trees, A. CIESLAR (*Centbl. Gesam. Forstw. Wien, 24 (1898), No. 1, pp. 21–34, figs. 8*).

Structure and weight of the best coniferous timber, R. HARTIG (*Forstl. Naturw. Ztschr., 7 (1898), No. 1, pp. 1–19*).

Conifers of the Pacific coast, J. G. LEMMON (*Sierra Club Bul., 2 (1898), No. 3, pp. 156–173, pls. 3*).

Evergreens—their use and value, E. H. RICKER (*Nebraska State Bd. Hort. Rpt. 1897, pp. 56–61, figs. 8*).—Notes are given on the value of different evergreens for forest planting, together with directions for their propagation.

Ash of Gidgea acacia (stinking wattle), F. B. GUTHRIE (*Agr. Gaz. New South Wales, 8 (1897), No. 12, pp. 868, 869*).—An analysis of the ash of *Gidgea acacia* is reported; also a partial analysis of the leaf.

SEEDS—WEEDS.

Preliminary report on the artificial use of enzyms in germination, F. A. WAUGH (*Vermont Sta. Rpt. 1896–'97, pp. 106–111, figs. 2*).—The author reports upon a series of experiments conducted with various unorganized ferments to ascertain their effect on the germination of various seeds. The enzyms used were pepsin, diastase, extractum pancreatis, trypsin, enzymol, and diastatic essence of pancreas, using them in different strengths of solution. Among several hundred preliminary experiments, many gave negative results and frequently the effect of the enzym solution was detrimental. The temperature at which the treatment and germination are made is of great importance, and it seems probable that the particular enzym combination must be separately determined for each species of seed. The author has tabulated the results of his experiments with tomato, cucumber, radish, and watermelon seeds ranging from 5 to 12 years old. The seed were soaked in different solutions from 24 hours to 1 week before planting, and the percentages of germination are compared.

The following table gives the percentages of germination of seed soaked in different enzym solutions, 50 or 100 seeds being used in every case:

Germination of seed soaked in enzym solutions.

Kind of seed.	Age.	Time of soaking.	Water.	Pepsin (5 per cent).	Diastase (5 per cent)	Diastase and pepsin.	Extract pancreatis.	Trypsin.	Enzymol.	Diastatic essence of pancreas.
Tomato:	*Years.*	*Hours.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Hundred day	12	168	12	[1]80 70	85 84	....	....	....	....	....
Do	12	48	34	....	70	38	....	....	....	....
Early King Humbert	12	24	14	....	24	....	....	....	....	....
Do	12	24	28	....	....	....	34 36	56 44	44 52	36 22
Essex Hybrid	9	24	0	....	10	....	36	4	8	8
Long Keeper	5	25	36	....	46	....	....	....	....	....
Do	5	24	76	....	....	....	70 80	70 86	90 80	64
Cucumber, White Spine	5	48	44	....	54	54	....	....	....	....
Radish, Carmine Erfert	6	48	46	28 26	66 60	....	....	....	....	....
Watermelon, Light Icing	9	24	20	60 70	....	....	....	....	....	....

[1] Where two figures are given, the first indicates double strength of solution.

The following tentative generalizations are given:

"In some cases the percentage of germination in seeds is greatly increased by soaking for several hours in a solution containing some active enzym or enzyms.

"The vigor of the young plantlets is often enhanced at the same time.

"Within limits these beneficial effects increase with the strength of the enzym solution.

"Diastase, either from malt or from various commercial preparations, seems to be most useful.

"Tomato seeds seem to respond especially well to the action of enzyms, particularly to the action of diastase."

Weeds and seeds, F. L. HARVEY (*Maine Sta. Rpt. 1896, pp. 113–116*).—Several causes for the distribution and spread of weeds are discussed, and the attention of farmers and others is called to the sources of distribution. The author believes that more bad weeds are introduced into the State through grain brought in by the carload for feed than by means of seeds. A lot of oats which had been brought from the West was purchased from a local dealer, who represented it as cleaned seed and charged several cents per bushel above the market price for it. Examination of a pound of this seed showed the presence of 1,160 mustard seed, 576 black bindweed, 111 goosefoot, 13 smartweed and sorrel, 28 flaxseed, 20 grass seed, several foxtail, 4 wild morning glory, 3 bugloss, and several seeds of 6 different kinds of Compositæ. Another sample examined (8 oz. of foul seed screened from oats bought for seed) contained seeds of the following: Black mustard, English charlock, jointed charlock, shepherd's purse, pigweed, bindweed, smartweed, bugloss, flaxseed, morning glory, several kinds of grass seed and Compositæ, and one seed that looked like Russian thistle.

Samples like the above are said to be not uncommon, and the author recommends that farmers should not import whole grain for feed. Other suggestions are given for the solution of the seed and weed question.

The vitality of seeds (*Sci. Amer., 78 (1898), No. 8, p. 121*).—Reports subjection of seeds to 180° C. without injury to their vitality.

The vitality of dormant and germinating seeds, F. Escombe (*Sci. Progress, n. ser., 1 (1897), No. 5, pp. 585–608*).—Gives a review and bibliography of literature relating to this subject.

Two weeds, J. T. Rothrock (*Pennsylvania Dept. Agr. Rpt. 1896, pp. 414–416, pl. 1*).—Brief notes are given of the blue thistle (*Echium vulgare*) and the yellow daisy (*Rudbeckia hirta*).

Noxious weeds, J. Fletcher (*Canada Expt. Farms Rpts. 1896, pp. 275, 276, fig. 1*).—A brief note is made on the cow cockle (*Saponaria vaccaria*), known also under the different names of cow herb, china cockle, and soapwort. "This plant has been noticed as an aggressive enemy in field crops only during the last 2 years, and so far only in the province of Manitoba, where it has spread very rapidly." The indications are that it was introduced from Europe in flaxseed.

The orange hawkweed, L. R. Jones (*Vermont Sta. Rpt. 1896–'97, pp. 62–74, figs. 5*).—This is an abridgment of Bulletin 56 of the station (E. S. R., 8, p. 987).

Notes on plants, F. L. Harvey (*Maine Sta. Rpt. 1896, pp. 109–112*).—Brief notes are given on various plants that were sent to the station for identification. Many of these were weeds, and methods for their destruction are suggested.

On the destruction of weeds with iron sulphate, Delarcharlonny (*Jour. Soc. Agr. Brabant-Hainaut, 1897, No. 49*).

DISEASES OF PLANTS.

Report of the botanist, L. R. Jones (*Vermont Sta. Rpt. 1896–'97, pp. 44–62*).—The results of the investigations on potato diseases, orchard diseases, oat smut, and onion mildew, and their remedies, are given. The conditions during the season of 1896 were rather unfavorable for the development of the fungi causing the diseases of potatoes. There was no occurrence of the late blight fungus at the station, but the other diseases of the potato occurred much as in the previous year.[1]

Studies of the fungi associated with the early blight were made, and an extensive bibliography of *Alternaria solani* is given. The synonymy of the fungus is also given.

Tests of various forms of Bordeaux mixture were made, in which a standard Bordeaux mixture, another containing one-half as much lime, and a Bordeaux powder were compared. Comparing the rows where the Bordeaux powder and the solutions were used showed conclusively that the Bordeaux powder is practically worthless as a fungicide. The results secured indicate that standard Bordeaux mixture (copper sulphate $1\frac{1}{2}$ lbs., lime 1 lb., water 10 gal.) and the mixture containing half as much lime gave almost identical results, and there is practically no

[1] Vermont Sta. Rpt. 1895, p. 78 (E. S. R., 8, p. 992).

choice between them. The solution of Bordeaux mixture when one-half the quantity of lime was used did not color the plants as much as the standard mixture, and on this account might be preferred where ornamental plants are sprayed or where there is danger of staining fruit.

The effect of disinfectants upon the growth of seed potatoes was tested, the seed being soaked 1½ hours in a 1:1,000 solution of corrosive sublimate. The seed tubers were soaked in this solution on the day of planting, and 46 and 96 days before planting. Comparisons were made with seed potatoes treated with formalin solution. The general conclusions drawn are that disinfecting with corrosive sublimate just before planting retards the early growth of plants, while if performed 1½ to 3 months before planting there is no such effect noticed. The use of formalin seemed to exert no retarding effect, but is said to have slightly stimulated the growth.

Brief notes are given on the diseases of apples observed during 1896. The most serious of these troubles is called the apple scald, and seemed most widely spread on Greenings. These apples, which appeared perfectly sound at the time of harvest, became discolored at various periods during the winter, a light brownish tinge appearing in fairly well-defined spots, which became more or less diffused over the surface. This light color passes to a dark-brown shade, and usually terminates in a black rot. Associated with the black rot is usually a fungus, but this is a secondary affair, the primary discoloration being due to a breaking down of the tissues of the fruit. Various theories are given relative to the conditions which may cause these diseases, the consensus of which is that the fruit had not attained perfect maturity at the time of storing. The author discusses the relation of conditions in the storeroom to the development of the scald, and shows that temperature and ventilation are important factors in its development.

The observations on oat smut were continued from the previous year, and the percentage of smut on the different varieties and plats for 1895–'96 are tabulated. The effect of the Jensen hot-water treatment on the yield of oats was tested, and where perfectly clean untreated seed was used there was no gain, and there may have been a decrease in the yield due to the hot-water treatment.

The studies on onion mildew reported previously in the report of this station for 1895, p. 113 (E. S. R., 8, p. 994), were continued and the conclusions reaffirmed. Field experiments were made with fungicides to test their efficiency in preventing the onion mildew, but the solutions did not adhere well to the leaves, and the Bordeaux mixture proved quite injurious on account of its too great strength. No mildew appeared in this field on any of the plats, consequently the fungicidal values were undetermined.

The cause of a brown rot in cruciferous plants, E. F. SMITH (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), Nos. 11–12, pp. 284–291; 15–16, pp. 408–415; 17–18, pp. 478–486, pl. 1*).—The author has made a study of a microorganism which is the cause of the bacteriosis of ruta-baga, described by L. H. Pammel.[1]

The author's attention was first called to the diseases on turnips which were brown rotted internally and usually hollow, the cavities presenting a more or less radial structure. He succeeded in isolating a yellow rod-shaped motile organism, which agreed in most particulars with that described by Pammel. Soon after diseased cabbages were received from Racine, Wisconsin, which were attacked by a microorganism, and the disease bore such a striking resemblance to that on the turnips as to suggest their possible identity. A series of experiments was conducted, which showed that the two diseases were due to the same germ and that they could be produced by cross inoculation. Further study showed that quite a number of cruciferous plants were capable of having this disease induced in their tissue through artificial inoculation.

One of the most striking symptoms of the disease is a brown or black staining of the tissues occupied by bacteria and, so far as the author's experience goes, the decay induced is that of a sort of dry rot. The disease is peculiarly a vascular one, and the rapid distribution of the bacteria is due to the fact of their motility. Various methods of natural infection were investigated and it was found that the disease could be spread in the greenhouse by slugs and various leaf-eating insects. The water pores at the margins of the leaves were also found to be avenues for infection. The author believes it probable that a majority of the natural infections in the field take place above ground, the disease being transmitted to healthy plants as the result of visits of insects or other small animals, and also that the disease may be transmitted from field to field by the way of the manure pile. He suggests as preventive measures (1) that susceptible plants should not be cultivated on land subject to this disease, (2) the prompt removal of diseased plants, and (3) the destruction of insect enemies and other possible carriers of the disease.

In the concluding portion of this paper the organism is described, its appearance on beef bouillon, cabbage broth, gelatin, agar, potato, and other media given, and its action in fermentation tubes and its thermal relations stated.

According to the system of bacteriological nomenclature adopted by the author, the organism was not properly referred by the original discoverer and it has been given the name *Pseudomonas campestris*. It is described as follows:

"A yellow, rod-shaped, motile microorganism. Size and color varying according to substratum, food supply, etc. Generally 0.7 to 3.0 by 0.4 to 0.5 μ. One polar flagellum. Nonsporiferous, so far as known. Pathogenic for various cruciferous plants, entering and dwarfing or destroying the host plant through the vascular system, which becomes decidedly brown. Aerobic but, so far as known, not a gas

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[1] Iowa Sta. Bul. 27 (E. S. R., 6, p. 998).

or acid producer, *i. e.*, not facultative anaerobic. Forms cavities around the bundles, but seems to be only feebly destructive to cellulose. Produces a brown pigment in the host plants and on steamed cruciferous substrata, especially the turnip. Grows very rapidly on steamed potato cylinders at room temperatures but without odor or the formation of any brown pigment. Liquefies gelatin. Grows well at 17 to 26° C., and is killed by 10 minutes' exposure to 51° C. Organism closely related to Wakker's *Bacterium hyacinthi*, from which it differs chiefly in its pathogenic properties, its duller yellow color, and its higher thermal death point."

The black rot of the cabbage, E. F. SMITH (*U. S. Dept. Agr., Farmers' Bul. 68, pp. 22, fig. 1*).—The author gives a popular bulletin on the black rot of cabbage, which is of bacterial origin, due to *Pseudomonas campestris*. Technical descriptions of this disease have been previously given.[1] The disease in cabbage is characterized by the dwarfing or one-sided growth of heads or, if the disease is very severe and began early in the season, by the entire absence of heads and, in extreme cases, by the death of the plant. If the stumps of affected plants are broken or cut across, a brown or black ring will be observed corresponding to the woody part of the stem, this being the part of the plant subject to disease.

The cause of the disease, as has already been stated, is bacterial, the germ entering the plant above ground and usually at the margin of the leaves through the water pores. It is not confined to cabbage, but attacks a number of other plants belonging to the mustard family. The common charlock or wild mustard is very subject to the disease and may be the means of causing its spread.

An account is given of field studies made in 1897, together with its geographical distribution. At present it is known to occur in Alabama, Kentucky, Iowa, Nebraska, Illinois, Indiana, Ohio, Minnesota, Wisconsin, Michigan, New York, Pennsylvania, New Jersey, Maryland, Virginia, and possibly Florida. The different methods of introduction and transmission are discussed, as well as the susceptibility of different varieties. Indications seem to show that the parasite lives over winter in the soil.

Suggestions for the prevention of disease are given, the principal of which briefly summarized are to plant the cabbage seed in a seed bed where the disease has never occurred and set plants on land which has not been in cabbage or other cruciferous plants for some years. As a matter of precaution, the use of stable manures should be avoided, since they may possibly serve as a means of conveying the germs to uninfected fields. Infection must be guarded against from tools used on infected lands or allowing stock to pasture over the different fields. The cabbage butterfly and harlequin cabbage bug must be constantly kept in subjection, as it is probable that they are very efficient means in spreading the disease. As a palliative remedy all diseased plants should be removed as quickly as they appear, and weeds, especially

[1] Iowa Sta. Bul. 27 (E. S. R., 6, p. 998); Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 11–12, p. 284 (see above).

wild mustard, which harbors the disease, must be destroyed. If the cabbage is stored in the fall, all heads showing any trace of black in the stem should be rejected and the others stored in a house in all parts of which the temperature is kept below 40° F. If any affected heads are stored they should be kept by themselves in a separate part of the house.

A bacterial disease of celery, U. BRIZI (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 21–22, pp. 575–579*).—A report is given of a bacterial disease of celery which was observed during the past season at several places in the lower part of the valley of the Po River, Italy. The bases of the large petioles of the leaves, especially when covered with earth, become discolored, while the remaining green portions of the leaves are spotted with small yellow specks which finally change to a rusty red. With the appearance of the spots the tissues become diseased and broken down and at the same time ulcer-like patches appear with great rapidity, destroying the tissue of the leaf. Finally there are formed large reddish areas surrounded by a definite line, the whole extending through the leaf.

Examinations of the ulcers revealed the presence of innumerable bacteria about 2 to $2\frac{1}{2}$ μ in length, to which the provisional name *Bacterium apii* has been given. The organism is attenuated at its extremities, motile, and fully occupies the tissues where found, often appearing in the collenchyma and in the tissues immediately surrounding the vascular bundles.

The organism is readily grown upon a variety of media. On gelatin it grew best at temperatures of from 20 to 22° C., colonies appearing in 18 to 24 hours and assuming their characteristic appearances in from 5 to 6 days. Its growth on different media and action toward various staining reagents are fully described.

Attention is called to the bacterial disease of celery described by Halsted[1] and a disease mentioned by Russell some time later. The identity of this disease in Italy with those occurring in the United States is not affirmed nor denied, the author merely claiming the first description of the Italian disease.

The core rot of apples and pears, J. CRAIG (*Canada Expt. Farms Rpts. 1896, pp. 172, 173, fig. 1*).—A brief note is given on a core rot of apples and pears to which the Gideon apple and Bessemianka and Sapieganka pears, 2 Russian varieties, are particularly subject. The core of the apple, which is at first water-cored, becomes brown and shrunken, separates the carpels from the surrounding pulp, and remains suspended in the interior of the fruit. Varieties that are affected by this disease should be avoided, or, if grown, the fruit should not be kept late in the winter, as its value will be lost.

A dry rot of apples, J. CRAIG (*Canada Expt. Farms Rpts. 1896, pp. 171, 172, fig. 1*).—Notes are given on the occurrence of a peculiar dry rot of apples which has been observed for several years. The dis-

[1] New Jersey State Sta. Bul. Q (E. S. R., 3, p. 885.)

ease is externally manifest by circular depressions on the surface of the apple. On removing the skin each depression is found to be the center of a small area of dryish brown tissue. The affected flesh is dry and without flavor, but not bitter. Some varieties seem to be more severely attacked than others, and, while the fruit is not wholly unfit for use, its appearance and salability are greatly affected. The disease is compared with several other of the better known diseases of apples, and is thought to be distinct from them. The specific cause of the disease is in some doubt, it having been attributed to a species of Dothidea, while others consider it a fruiting form of *Fusicladium dendriticum*. The life history of the disease is a subject for further investigation.

Apple and pear blight, J. CRAIG (*Canada Expt. Farms Rpts. 1896, pp. 168–171*).—Brief notes are given descriptive of the apple and pear blight, together with suggested remedies, which consist in removing diseased branches and spraying with Bordeaux mixture. The spraying alone has been tried without success. A tabulated report is given on the resistance to blight of about 140 varieties of Russian apples in an orchard at Ottawa. The record covers the years 1893 to 1895, inclusive, and shows a considerable variation in the resistant power with the different varieties, and the same variety in different seasons.

Spraying, J. CRAIG (*Canada Expt. Farms Rpts. 1896, pp. 173–175, fig. 1*).—A report is given on experiments conducted with various combinations of fungicides and insecticides with a view to preventing the cracking of pears and injury by the late brood of codling moth. The fruit of both sprayed and unsprayed trees was uniformly free from fungus attacks and no results were gained in this respect. The spraying mixtures used were solutions of arsenate of lead, lysol, copper carbonate, and Paris green. The fruit of one Bartlett tree of each series which had been sprayed twice with each mixture was picked and graded, and it was found that the tree sprayed with lysol gave the largest percentage of sound fruit.

These experiments gave results somewhat contrary to those of the previous year, especially in respect to the use of arsenate of lead, and are to be repeated. Notes are also given on the injury to apples by spraying with Bordeaux mixture, and directions are given for its prevention.

The fungus foes of the farmer, B. D. HALSTED (*Pennsylvania Dept. Agr. Bul. 28, pp. 19, figs. 6*).—Brief popular notes are given of the more common and destructive diseases of farm crops, root crops, vegetables, and orchard and small fruits.

Three years' experience with club root, B. D. HALSTED (*Amer. Gard., 19 (1898), No. 162, p. 74, fig. 1*).

Potato scab, SCHELLENBERGER (*Fühling's Landw. Ztg., 46 (1897), No. 22, p. 651*).

Diseases of the Irish potato, R. H. PRICE (*Texas Sta. Bul. 42, pp. 923–926, figs. 4*).—Brief popular notes are given describing the early blight (*Macrosporium solani*). late blight (*Phytophthora infestans*), potato scab (*Oöspora scabies*), and dry rot (*Fusarium solani*). Directions are given for their prevention.

The rusts of cereals, D. PINOLINI (*La ruggine dei cereali. Novara, 1897, pp. 20*).

Some diseases of cereals, T. POGGI (*Alcuni mali del frumento. Casale, 1897, 2. ed.*).

A disease of chestnuts, V. DUCOMET (*Prog. Agr. et Vit., 29 (1898), No. 5, pp. 152–157*).

The sclerotium disease of Alnus fruits, O. ROSTRUP (*Ztschr. Pflanzenkrank., 7 (1897), No. 5, pp. 257–260, figs. 3*).

Concerning a disease of Anemone nemorosa, H. KLEBAHN (*Ber. Deut. Bot. Gesell., 15 (1897), No. 10, pp. 527–536, pl. 1*).—The author figures and describes a disease of *Anemone nemorosa* which is due to an undescribed fungus, *Trichodytes anemones*, n. sp.

The bacteriosis of carnations, A. F. WOODS (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 25–26, pp. 722–727, pl. 1, fig. 1*).—The substance of this article has already appeared as a bulletin of the Division of Vegetable Physiology and Pathology of this Department (E. S. R., 9, p. 657).

Black spot of rose leaves, B. D. HALSTED (*Amer. Florist, 13 (1898), No. 504, pp. 685, 686, fig. 1*).—Notes are given on *Actinonema rosæ*. Its attacks may be prevented by the more common fungicides.

The action of bacteria on plant tissues, O. ZINSSER (*Jahrb. Wiss. Bot., 31 (1897), No. 4, pp. 423–452*).

Notes on Puccinia galanthi, F. BUBAK (*Oesterr. Bot. Ztschr., 47 (1897), No. 12, pp. 436–439, pl. 1*).

Experimental investigations on the origin of the galls and their formation in the spruces, P. NOTTBERG (*Ztschr. Pflanzenkrank., 7 (1897), No. 5, pp. 260–287, figs. 7*).

The parasitic fungi of the Wisconsin Valley, L. S. CHENEY (*Trans. Wisconsin Acad. Sci., Arts, and Let., 10 (1894–'95), p. 69*).

Rust, smut, mildew, and mold. An introduction to the study of microscopic fungi, M. C. COOKE (*London: W. H. Allen, 1897, 6. ed., pp. 270, col. ills. 269*).

Contributions to the Swiss rust fungi, E. FISCHER (*Bul. Herb. Boissier, 6 (1898), No. 1, pp. 11–17*).—Descriptions of the following new species are given: *Puccinia æcidii-leucanthemi* and *P. carices montanæ*, and notes on the Uromyces of the Alpine primulas, *Gymnosporangium juniperinum*, and *G. tremuloides*, and on *Cronartium ribicolum*.

On the resistance to mildew of certain varieties of grapes, R. BRUNET (*Jour. Agr. Prat., 62 (1898), No. 5, pp. 173, 174*).—The author tabulates a number of stocks in the order of their resistance.

Potato rot—Bordeaux mixture and Fungiroid as preventives (*Maine Sta. Rpt. 1896, pp. 158–162*).—Reprint of Bulletin 28 of the station (E. S. R., 8, p. 237).

A new method of destroying nematodes and injurious fungi in soils (*Braunschw. Landw. Ztg., 65 (1897), No. 51, p. 220*).—Reprinted from Blätter für Zuckerrübenbau.

Spraying, A. B. CORDLEY (*Oregon Sta. Bul. 48, pp. 19, figs. 3*).—Compiled and original notes are given on the efficiency of spraying for the prevention of fungus and insect enemies of fruits, etc. Formulas and directions for the preparation and application of fungicides and insecticides and a spray calendar are given.

Notes on spraying, W. M. MUNSON (*Maine Sta. Rpt. 1896, pp. 162–165*).—Reprint of Bulletin 29 of the station (E. S. R., 8, p. 240).

ENTOMOLOGY.

Some little-known insects affecting stored vegetable products, F. H. CHITTENDEN (*U. S. Dept. Agr., Division of Entomology Bul. 8, n. ser., pp. 45, figs. 10*).—This is a collection of articles detailing certain original observations made upon insects of this class.

A storehouse moth new to the United States, with notes on other species (pp. 7–10).—The dried currant moth (*Ephestia cahiritella*) was obtained both at the World's Columbian and the Cotton States Expositions and was brought prominently to the author's attention in material collected at Atlanta. It was found in nearly every exhibit of chocolate nuts or cacao beans. The moth looks much like *Ephestia kuehniella* and also *E. elutella*, but it may be distinguished from the former by the strong subdorsal line of the cilia of the hind wings. The larva resembles that of the flour moth, exhibiting the same color variation, the green hues ranging from dirty whitish to gray or yellowish. The flesh tints are arranged along the dorsum so as to form with the piliferous warts (which are darker than in *E. kuehniella*), a distinctly striated appearance not present in the latter species. The larvæ were found in a lot of flax-seed meal from Calla, Ohio, and in English walnuts, figs, and pearl hominy obtained from various markets and street venders. A larva was found in a small box of duplicate moths to which it had wrought much damage.

Ephestia elutella, the chocolate moth, is also noted as a new American pest. It has been found breeding in cayenne pepper at Iowa City, Iowa, in dried apples from New York, and in cacao beans from Montserrat, West Indies; and, according to various European authorities, in manufactured chocolate, coffee, various dried fruits, and ship biscuit.

The storehouse moths liable to introduction are *Ephestia ficulella*, which preys upon figs and currants and has been found in oatmeal; *E. calidella*, which feeds on dried figs, raisins, and currants; *Ephestia* (?) sp., an unknown phycitid larva resembling Ephestia, which has been found in pressed figs in Washington; and *Myelois ceratoniæ*, found in a box of seed pods of St. John's bread (*Ceratonia siliqua*) exhibited by the Spanish Colonies at the Columbian Exposition. Another moth noted is *Corcyra cephalonica*, which occurs in dried currants in Europe.

Notes on grain beetles of the genus Silvanus (pp. 10–13).—Under this head the author considers *Silvanus bicornis*, *S. mercator*, and *S. gossypii*, n. sp. The distinctive features of each are pointed out. The second form was found at the Columbian Exposition in material from Venezuela, Vienna, and Italy, and at the Atlanta Exposition in material from Venezuela. It has also been found in a lot of ground flaxseed from Calla, Ohio. *S. gossypii* was found in cotton seed from India. It has not yet been introduced into this country.

Granivorous and other habits of certain Dermestidæ (pp. 14–24).—According to recent observations, at least 4 common species, namely, *Attagenus piceus*, *Trogoderma tarsale*, *T. sternale*, and *Anthrenus verbasci*, have vegetarian proclivities. The larvæ of *Attagenus piceus* have been found in wheat and flour from central Indiana, in middlings, corn meal, in pumpkin seeds, and in millet at Washington. After a few notes on the injury of insects to bolting cloth—injuries which have been incorrectly attributed to *Tenebroides mauritanicus*—the author reviews briefly the history of the species in America and then briefly describes it.

Trogoderma tarsale has been found in flaxseed, peanut-oil cake and dust, Indian turnips, wheat, corn, "kulu," cayenne pepper, and in beehives. They were found breeding in cayenne pepper.

Trogoderma sternale has been found in sample seeds, in linseed, castor beans, silkworm cocoons, and in red-clover seed. In the jars of cocoons it was found associated with *Trogoderma tarsale* and a few individuals of *Attagenus piceus.*

Anthrenus verbasci (pp. 22, 23).—To the two instances[1] in which this species has been noted as attacking vegetable substances the author adds that the species has been found in middlings, in spoiled flour, in peanuts, and in meal, flour, and cakes prepared from them, and from peanut-oil cake, in seed wheat, and in cayenne pepper. Experiments showed that they will make themselves at home in fresh flour. The change from the natural animal-feeding habit to a vegetable one is attributed to altered environments.

Weevils that affect the seed of the cowpea (pp. 24–29).—The author here considers *Bruchus chinensis* and *B. quadrimaculatus*, which he compares, and in both cases notes the records of damages, distribution, and development, and, in the case of *B. chinensis*, the natural enemies.

Development of the common bean weevil (pp. 29, 30).—From the author's studies of this insect (*Bruchus obtectus*), it appears that the egg stage lasts from 5 to 20, the larval stage from 11 to 42, the pupal stage from 5 to 18, and the entire life cycle from 21 to 80 days. The development is much affected by temperature.

A little-known grain weevil (*Caulophilus latinasus*) (pp. 30, 31).—This insect was collected at the Atlanta Exposition, where it was found living in Indian corn, Spanish peas, or chick peas, from Mexico. This case appears to be the only recorded instance of its occurrence in either stored cereals or legumes, but it has been found at Kingston, Jamaica, in ginger.

On the occurrence of the grain moth (*Tinea granella*) *in America* (pp. 31–35).—This wolf, or little grain moth, of Europe, is noted as occurring rarely in this country. The fact is pointed out that *Plodia interpunctella* affects grain in much the same manner. It is thought very likely that many of the leading cases of damage attributed to *T. granella* are due in reality to *Plodia interpunctella.* According to recent reports, *T. granella* has been found in stored wheat from California and bred from larvæ taken from a sack of corn meal from San José. It has been found by 7 station entomologists in as many States. The species likely to be confused with *T. granella* are *T. pali*, *T.* spp., *T.* (*Scardia*) *cloacella*, and *T. defectella.* Of the unnamed species one was found in breeding *T. pali*, the other in breeding *T. cloacella.* *T. pali* was found in Yucca pods from Mexico. The question of the presence in America of *T. granella* is thought to rest upon rather insecure footing. The cases recorded are supposed to be instances of accidental introduction.

An invasion of the coffee bean weevil (pp. 36–38).—Specimens of this weevil (*Aræcerus fasciculatus*) were found in dried apples in Washington. They had been introduced in Java coffee. The beetle is figured and described. The species is also noted as feeding on seed pods of

[1] Insect Life, 7, p. 32; Field and Forest, 2 (1877), p. 184.

the so-called coffee weed or senna (*Cassia occidentalis* and *C. obtusifolia*), the seeds of the wild indigo of Florida (possibly either *Indigofera tinctoria* or *I. anil*), on dried orange from Florida, in cacao beans from Liberia, and in mace from Trinidad and Jehore.

Parasites of flour and meal moths (p. 38).—Notes are given on the parasites in the following list, in which the names of the parasites follow the name of the host: *Ephestia kuehniella—Hadrobracon hebetor* (syn. *Bracon brevicornis*), *Apanteles ephestiæ, Chremylus rubiginosus; E. elutella—Hadrobracon hebetor; E. cahiritella—Hadrobracon hebetor, Omorga frumentaria; Plodia interpunctella—Hadrobracon hebetor, Omorga frumentaria, Limneria ephestiæ; Pyralis farinalis—Apanteles carpatus, Perilitus ictericus, Exochus mansuetor*, unknown ichneumonid, *Spalangia rugicollis* (secondary), *Melanophora roralis, Clausicella tarsalis, Carcelia leucaniæ; Tinea granella—Chremylus rubiginosus, Omorga frumentaria, Hemiteles tineæ;* and *Galleria mellonella—Hadrobracon hebetor.*

A foreign parasite of the grain weevils (pp. 43–45).—The author discusses the only hymenopterous parasite known to infest the grain weevils in the United States, namely, *Pteromalus calandræ*, which is now referred to the genus Meraporus. The author considers it an introduced cosmopolite. Some remarks are made on the taxonomy, and the insect is described.

Report of the entomologist and botanist, J. FLETCHER (*Canada Expt. Farms Rpts. 1896, pp. 226–276, pl. 1, figs. 18*).—Accounts are given of insects affecting cereals, fodder crops, fruits, etc., and apiary experiments.

Cereals (pp. 226–229).—The following insects are noted: Hessian fly (*Cecidomyia destructor*); the jointworm (*Isosoma hordei*); grain plant louse (*Siphonophora avenæ*); amputating brocade moth (*Hadena arctica*), which was very abundant in some parts of Ontario during 1895, and gave considerable annoyance by soiling clothes and curtains and by dying in large numbers in shop windows; in the same districts during 1896, wheat, oats, and corn were destroyed; pea moth (*Semasia* sp.), which is again attracting attention by the extent of its injuries; the wheat stem sawfly (*Cephus pygmæus*), of which a summary of the life history is given; and the army worm (*Leucania unipuncta*).

Fodder crops (pp. 234–243).—The insects noted as attacking fodder crops are the clover root borer (*Hylesinus trifolii*), white grubs (*Lachnosterna*), cottony grass scale (*Eriopeltis festucæ*), grasshoppers (*Melanoplus femur-rubrum, M. bivittatus*, and *M. atlanis*), the parasites (*Empusa grylli*), tachina flies, hair worms, *Trombidium locustarum*, the gray blister beetle) of which are noted.

In discussing hair worms (Gordius, etc.), it is noted that 2 small specimens of Mermis were taken from a ladybird (*Hippodamia 13-punctata*).

It is reported that on Sable Island locusts were so destructive that it was necessary to purchase hay to keep stock through the winter.

Root crops and vegetables (pp. 243–250).—Few complaints were received, but the following insects are noted: Turnip flea beetle (*Phyllotreta vittata*), red turnip beetle (*Entomoscelis adonidis*), which did considerable damage in the Northwest Territories and in Manitoba; striped cucumber beetle (*Diabrotica vittata*), clover cutworm (*Mamestra trifolii*), zebra caterpillar (*Mamestra picta*), which was abundant in the western parts of Ontario, but was much affected by the parasites *Trichogramma pretiosa* and *Telonomus* sp., and by Apanteles; small white cabbage butterfly (*Pieris rapæ*), which affected turnips as well as cabbages injuriously; Colorado potato beetle (*Doryphora 10-lineata*), and red backed cutworm (*Carneades ochrogaster*).

Fruits (pp. 250–264).—There are noted the codling moth (*Carpocapsa pomonella*) eye spotted bud moth (*Tmetocera ocellana*), cankerworms, cigar case bearer (*Coleophora fletcherella*), oyster shell bark louse (*Mytilaspis pomorum*), pear tree slug (*Eriocampa cerasi*), plum webworm (*Lyda rufipes*), San José scale (*Aspidiotus perniciosus*), which was discovered in Vancouver Island, where the pest must have existed on the trees affected for some time; plum curculio (*Conotrachelus nenuphar*), grape phylloxera (*Phylloxera vastatrix*), peach bark borer (*Phlœotribus liminaris*), black peach aphis (*Aphis persicæ-niger*), apple maggot, and apple fruit miner, which has become a serious enemy to the apple growers on the Pacific Coast, where it attacks the apple at about the same time and in much the same way that the apple maggot does in the East. The apple fruit miner is abundant in the wild crab, and its habit of attacking apples seems acquired and exceptional, but persistent. Appended to the foregoing is a note on the horn fly (*Hæmatobia serrata*).

Experiments in wintering bees, J. Fixter (pp. 264–271).—During 1895, 1896, and 1897 experiments begun in former years were continued. The most satisfactory way of wintering in a cellar was found from these experiments to be the following: Hives are placed in the cellar, raised from the floor by empty hives or other means, and arranged in tiers with the back of the hive raised somewhat higher than the front, and each hive raised from its bottom board by a small block ⅜ in. high. All front entrances are left wide open so as to give free ventilation. The wooden covers of the hives are replaced by chaff cushions 4 in. thick, above which are placed strips of wood to prevent their coming in contact with the hives above. In hives packed with sawdust, preventing ventilation, bees were smothered, and in hives similarly treated, but with ventilation, the colonies were weakened by heat, dampness, and insufficient ventilation. Hives packed with chaff and left out of doors on the ground without ventilation, or with none other than the ventilating shaft, were found to have been sufficiently protected, but in the former case to have suffered considerably from water which found its way into the hive.

Notes are also given on buckwheat, 5-banded Italian bees, a hive in a wood shed, the daily gain in honey of a hive, a bee cellar, and wintering experiments in 1896 and 1897; and a few suggestions are made to beginners in apiculture.

A swarm of bees taken June 13, weighing $6\frac{3}{4}$ lbs., furnished with 4 frames of drawn comb and 4 frames of foundation placed alternately, and kept on scales for 11 weeks from June 17, made a total net gain of $90\frac{3}{4}$ lbs., the largest gain of any one day being $6\frac{1}{4}$ lbs. This gain was made on two days, one during clover and the other during basswood flow. There is noted also a loss of $7\frac{1}{2}$ lbs., which is the sum of losses noted in 4 different weeks and which the author apparently attributes to the differences connected with the weight of brood, etc.

Report upon further experiments with certain brands of comb foundation, F. T. Shutt (pp. 271–275).—The experiments of former years were continued. The results of this year's work apparently show, taking the values of comb foundation as depending upon the extent to which it is used by bees in cell formation, that what the author designates choice wax made on the Root mill at a temperature of 89° F. gives the best results, while the foundation made by a patent process and running 12 or 15 sq. ft. to the pound gives the poorest results. In the former case the average percentage of the wax of the foundation utilized by the bees was 52, as contrasted with 12 in the latter case. A poor quality of wax in any of the foundation used seems to give bad results. In obtaining percentages noted the method was followed of paring off the cells of the comb and comparing the weight of the piece thus obtained with that of the foundation when placed in the hive.

Report of the entomologist, A. D. HOPKINS (*West Virginia Sta. Rpt. 1893, pp. 29–48*).—After stating that the common insect pests were not sufficiently numerous during the year to attract serious attention, the pine bark beetle is noted as occasioning great damage during 1891–'93. "Never before in the history of the country has such widespread and universal destruction of timber been caused by the ravages of insects." Extensive travel through the spruce and pine forests of the State showed that the death of the trees was due to the attack of *Dendroctonus frontalis*. As the result of a circular letter mailed to various timber owners, setting forth the dangerous character of the attack, some $750 was contributed, to which the station added $150, for the purpose of carrying on investigations and to import predacious insects from Germany. After a number of weeks of study in Europe *Clerus formicarius* was chosen from a number of benficial predacious insects for importation. As a beginning 50 specimens, male and female, and 25 larvæ were placed on dying trees near Morgantown. During the following spring and summer (1893) colonies of often as many as from 30 to 100 each were placed throughout the State. In all, including insects from a second importation, 14 distributions were thus made. The number of the pests were so decimated by disease, etc., as not to threaten any material damage in the future.

There is also noted a study of a new potato disease, due to the larvæ of a dipterous insect; and a new peach tree pest, the peach twig moth (*Anarsia lineatella*).

Annual report of the entomologist, A. D. HOPKINS (*West Virginia Sta. Rpt. 1895, pp. 27–35*).—During the year attention was given to an insect affecting chestnut, oak, and pine bark, which in some instances did considerable damage. Among the discoveries made during the year was an adult of the chestnut timber worm, which proved to be an insect entirely different from what either Harris or Riley had supposed. *Xyletinus peltatus* was found doing damage to pine barn flooring, and it was further noted as a dangerous enemy to seasoned wood of all kinds, especially in outbuildings. Other insects noted are an enemy of the poplar, a new apple tree pest, a new enemy of plum trees, which is probably an imported European pest, the bagworm, clover leaf mite, and an oyster shell bark louse. A new form of potato scab is also noted.

Notes on the insects of the year, F. L. HARVEY (*Maine Sta. Rpt. 1896, pp. 117–123, figs. 7*).—The following insects are noted: Croton bug (*Phyllodromia germanica*), oyster shell bark louse (*Mytilaspis pomorum*), which is abundant and increasing; hemispherical scale (*Lecanium hemisphæricum*), elm tree bark louse (*Lecanium* (?), the fall cankerworm (*Anisopteryx pometaria*), mourning cloak butterfly (*Vanessa antiopa*), oak bark weevil (*Magdalis olyra*), steel blue flea beetle (*Haltica chalybea*), buffalo tree hopper (*Ceresa bubalus*), which was this year reported for the first time as doing damage to apple trees; yellow necked apple tree caterpillar (*Datana ministra*), reported this year for the first time as feeding on the foliage of apple trees; the currant spanworm (*Diastictis ribearia*), very abundant about Orono; gooseberry fruit worm (*Dakruma convolutella*), which is apparently on the increase; lime tree winter moth (*Hybernia tillaria*), which is reported in injurious numbers and seems to remain where the fall cankerworm is about to disappear; the army worm (*Leucania unipuncta*), the ash gray pinion (*Lithophana antennata*), velleda lappet moth (*Tolype velleda*), which has never been found before in Maine and was received from the western part of the State, where it was mistaken for the gypsy moth; apple tree tent caterpillar (*Clisiocampa americana*), which is very abundant in western and southern Maine; currant fly (*Epochra canadensis*), which is not generally distributed, but badly infested some gardens in Orono; apple maggot (*Trypeta pomonella*), which has nearly disappeared in several localities; rat tail larva (*Mollota*), horn fly (*Hæmatobia serrata*), which seems to be on the decrease; buffalo beetle (*Anthrenus scrophulariæ*), pigeon tremex (*Tremex columba*), and *Ptinus fir*, which was reported as badly infesting a bag of timothy seed. The great number of leaf-eating insects said to have been reported makes the season somewhat remarkable.

The army worm, B. H. WARREN (*Pennsylvania Sta. Rpt. 1896, pp. 164–220, pls. 16*).—A description is given of the moth, its eggs and larvæ, its life history, and its past history. The subject of parasites, predaceous insects, etc., is very briefly treated. Ditching and the use of coal tar or kerosene in the ditches is the only remedy recommended. A long series of letters is given which were received in reply to a circular sent out over the State. The most prominent feature of this is the estimate of loss, which foots up about $300,000. The greatest loss noted by a single individual is $400. One is reported at $300 and several at $200. Among the damages done by the worm there is noted a destruction of the uniformity of a lawn by their producing a ragged appearance along the edges of the walks. Swallows, fly catchers, crows, blackbirds, robins, catbirds, thrushes, meadow larks, bluebirds, sandpipers, the screech owl, sparrow hawk, and the skunk are mentioned, each more or less at length, as enemies of the worm. The plates are all colored.

The red spider, G. H. PERKINS (*Vermont Sta. Rpt. 1896–'97, pp. 75–86, figs. 4*).—An account is given of the life history of the red spider (*Tetranychus telarius*) taken partly from notes made by J. H. Worcester. These so-called spiders vary in color more or less according to the food plant upon which they are found and according to their age. On some plants red mites may be very numerous, on others there will be found few red, but many greenish or brownish ones. When young they are light yellowish or whitish. Somewhat later 2 red spots appear on each side of the back. These spots may be all the red that is developed, or the color may spread and increase in depth with age so that the spots become completely obliterated. Very fine webs are spun.

The eggs, which are relatively large, spherical, and light yellow or colorless, are laid at intervals of a few days, the female remaining in one spot the while. In about a week, according to conditions of temperature, etc., an oval six-legged mite hatches out and 2 days later sheds its skin, grows, and repeats the process twice at internals of 2 days. Immediately after the third molt, if males happen to be present, the female is impregnated by one or more and within 48 hours begins laying. From 2 to 8 eggs per day are deposited for as many as 3 weeks, producing during that time a total of 50 to 100 eggs. One impregnation suffices for a lifetime. If no males chance to be present the female proceeds to lay unfertilized eggs, which hatch out males. This may go on until the female is impregnated, after which a majority of female eggs may be produced. The mites show a very friendly and peaceable disposition. The males seldom quarrel, even over the possession of a female. Occasionally, however, the males apparently fight, darting at one another and apparently endeavoring to pull away one another's tongues, which are thrust out and withdrawn.

Under the head of remedies, the statement, based upon what seem to be conclusive experiments, is made that the mites are not so injuriously affected by excessive humidity of the atmosphere as to render the method of saturating the atmosphere with water vapor, as is often done in greenhouses, of practical value. But the mechanical action of water spurted on the plants, as has been recommended by the author for aphids, mealy bugs, and the like, is fairly effective, as also are soap emulsions. Sulphur fumes in some cases have proved satisfactory, but none of these remedies seem effectual against the eggs. Kerosene emulsion, however, is effective in all cases and will, it is thought, be found the most convenient and satisfactory remedy.

A new garden Smynthurid (Smynthurus albamaculata), F. L. HARVEY (*Maine Sta. Rpt. 1896, pp. 124–126, figs. 5*).—A detailed description is given of a new Smynthurid which the author calls *Smynthurus albamaculata*. It is found abundantly in gardens during May and June and does considerable damage to early garden plants, attacking radishes, beans, cucumbers, squashes, etc., in the leaves of which it eats numerous holes and sucks away the juices until the leaves wither. The habits are thus the same as *S. hortensis* of Fitch. The species is, however, readily distinguished from the latter species by the purple of the head, antennæ, terminal segments of the body and elater, and by the obscure white marking of the body, and especially by the 9 instead of 6 segments in the terminal portion of the antennæ.

The young are much lighter in color than the adults and often show only 8 segments in the terminal portion of the antennæ.

Under the head of remedies the author states that he can not agree with Fitch that the work of the smynthurids is entirely secondary, for this species, at least, seems capable of sucking the juices of plants without the aid of other insects. This species was very abundant on cucumbers in his garden, but there was no evidence of the flea beetle. Some dozen or more would sometimes be found on a single leaf and in a few days it would be noticed that the leaves turned whitish, and an examination of the epidermis would show the existence in it of numerous little pits. A hole through the leaf was rarely if ever found. The new leaves, cotyledons, etc., are attacked. Dirt, ashes, sulphur, or pyrethrum will act as deterrents until the plants are large enough to be out of danger.

A bacillus pathogenic upon the phylloxera and certain acarids, L. DUBOIS (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 20, pp. 790, 791*).—In a mixture of earth and manure the author found an organism that in certain hemiptera produces a veritable infectious disease. Apparently it enters the body through the mouth and may be found either by means of the microscope or by cultures in the bodies of insects that have succumbed to the disease. In certain solutions it seems capable of retaining its virulence for a very long time.

It exists in 2 forms: In filaments of 4 to 7 μ somewhat undulating in form, in links and as a coccus from 0.2 to 0.3 μ in diameter. The coccus is slightly motile and has an annular zone, usually distinguished as a somber tint surrounding a central rather clear area. There is no vacuole. In some cultures the cocci seem to develop from spores.

The organisms stain with difficulty by ordinary methods. The best results were obtained by the author with 10 cc. of a 25 per cent solution of tannin to which was added enough sulphate of iron to give the mixture a black color. The mixture was heated to 50° C. and then left on the cover glass for 25 minutes. The cover glass without washing was then plunged into a solution of 1 per cent potassium hydrate for 5 minutes. It was then washed in water and stained by the aid of heat with a soda anilin solution of fuchsin and finally stood in water. The stain thus obtained is instable and works with difficulty on cocci forms and on old cultures. The organism is an ærobic, at least with ordinary media. It develops well only in the absence of oxygen, but the growth is never luxuriant. The temperature limits are between 20 and 30°. Its virulence seems to vary with the chemical constitution of the soil and with atmospheric conditions.

In 12 lots of phylloxera experiments 2 lots were placed in the ground as control experiments, 8 were placed in earth in potatoes and sown with the organism, and 2 were placed on a lot of blotting paper. In 1 or 2 days the insects on the twigs of the last 2 lots were all dead. At the end of 5 days few living insects were found in the 8 lots, while in the control experiment plenty of them were found after the lapse of 7 days.

Report of the entomologist, L. Bruner (*Nebraska State Bd. Agr. Rpt. 1896, pp. 105–138, figs. 35*).—This consists of notes, descriptive and otherwise, on the common or injurious grasshoppers of Nebraska, with observations as to remedies. The latter portion of the paper is formed by a list of the short-horned grasshoppers occurring in the State.

Contributions to experimental entomology, E. Fischer (*Illus. Ztschr. Ent., 2 (1897), No. 44, pp. 689–695, pl. 1*).—Experiments in which *Vanessa antiopa, V. aberratio artemis*, and *V. aberratio hygiæa* were subjected to cold are described.

Species or subspecies, T. D. A. Cockerell (*Nature, 56, No. 1452, p. 391*).

Revision of the European and related species of the Ichneumonid genus Pimpla, O. Schmiedeknecht (*Illus. Wchnschr. Ent., 2 (1897), Nos. 32, pp. 506–511; 33, pp. 525–528; 34, pp. 539–543; 36, pp. 571–576; 37, pp. 589–591; 39, pp. 618–622; 40, pp. 633–638*).

The braconid genus Meteorus, O. Schmiedeknecht (*Illus. Wchnschr. Ent., 2 (1897), Nos. 10, pp. 150–154, figs. 5; 11, pp. 173–175; 12, pp. 184–190; 13, pp. 204–207; 14, pp. 221–223; 19, pp. 298–302*).

Diptera from the white sands on the Tularosa plains of southern New Mexico, I, C. H. T. Townsend (*Psyche, 8 (1897), No. 259, pp. 138–140*).—*Paragus bicolor testaceus, P. tibialis*, and *Zodion fulvifrons abdominale* all on flowers of *Aster parviflorus*.

Diptera of the Organ Mountains in southern New Mexico, I, C. H. T. Townsend (*Psyche, 8 (1897), No. 258, pp. 126–128*).—A brief description is given of the following, with the altitudes at which they were caught: *Eupeodes volucris*, 5,000 ft., on flowers of *Melampodium cinereum; Zodion splendens*, 5,000 ft., on *Zinnia grandiflora; Zodion fulvifrons*, 5,500 ft., on *Pectis papposa; Belvosia bifasciata*, 5,600 ft.

The Coleoptera of the lower Rio Grande Valley, H. F. Wickham (*Bul. Lab. Nat. Hist. State Univ. Iowa, 4 (1897), No. 2, pp. 96–115*).—Species of Cicindelidæ, Caribidæ, Haliplidæ, and Hydrophylidæ are noted. Only a score of specimens peculiar to Mexico were obtained, and these were found in a cotton field near Matamoras.

Winter case arrangement for bees, P. S. Orton (*Amer. Bee Jour., 37 (1897), No. 20, p. 305*).—A winter case costing about $3.50 and holding 10 two-story, 8-frame, dovetailed hives is described. It is 13 ft. long, 2½ ft. wide, and 2½ ft. deep. The hives stand 1 in. apart; the entrance is $\frac{7}{16}$ by 12 in. next a space in the case of $1\frac{1}{2}$ by 2 by 14 in. A block 1 by $1\frac{1}{2}$ by 2 in. is placed between each hive and the entrance to the strip $\frac{1}{2}$ by 2 in. by 13 ft. is nailed to the top of these blocks, thus forming 10 compartments of $1\frac{1}{2}$ by 2 by 14 in. The roof is of the gable sort and furnished with a lock. The floor of the porticos slants so that dead bees and the rain fall away.

A nonswarming device (*Amer. Bee Jour., 37 (1897), No. 16, p. 241, fig. 1*).—It is stated that bees desiring to swarm may be controlled by placing two hives side by side, each having a 6-inch tin tube inserted in a hole bored in the lower side of the middle of the front. When the entrance of one hive is closed the workers are obliged to come out through the tin tube and, being unable to get back, go into the adjoining hive. After several days the entrance to the second hive may be closed and that of the first one opened, which forces the bees back into the first hive again. The method is said in no way to interfere seriously with the working of the bees, but it effectually destroys the swarming fever and all queen cells that may have been formed are torn down.

The San José scale in Missouri, J. M. STEDMAN (*Missouri Sta. Circ. Inf. 3, pp. 10, figs. 3*).—A brief popular account of the scale, with a recommendation of the usual precautions and remedies.

A report on the occurrence of the cabbage root maggot, F. A. WAUGH (*Vermont Sta. Rpt. 1896–'97, pp. 116–119, figs. 1*).—It is briefly noted that cabbage, cauliflower, broccoli, and kale were found attacked by this insect (*Phorbia brassicæ*). There are a few comments on its distribution, method of feeding, life history, and treatment. The use of kerosene emulsion about the roots of the affected plants is recommended, as is also the preventive measure of placing tarred paper about the stem of the plant at transplanting time, and especially that of avoiding planting in ground where the insect has been at work the year before.

A further communication relative to the grapevine beetle, K. SAJÓ (*Illus. Wchnschr. Ent., 2 (1897), No. 9, pp. 129–134*).—The question as to whether *Eumolpus obscurus* has been found on the vine is discussed and affirmative evidence brought forth. Topsent's hypothesis that *E. vitis* and *E. obscurus* are one and the same, and that the difference in color is due to the food plant from which each may chance to be taken, is shown to be without the support of facts or even an investigation.

The beech woolly louse, C. SCHROEDER (*Illus. Wchnschr. Ent., 2 (1897), No. 15, pp. 225–229, fig. 1*).—*Schizoneura lanigera* is discussed. A wash of 50 parts soap, 100 parts amylalcohol, 200 of alcohol, and 650 of soft water is recommended.

Life histories of the New York slug caterpillars, X–XI, H. G. DYAR (*Jour. New York Ent. Soc., 5 (1897), No. 2, pp. 57–65, pls. 2*).—*Euclea delphinii* (with the food plants—oak, chestnut, bayberry, Andromeda, beech, sour gum, and wild cherry) and *Parasa chloris* (food plants—oak, chestnut, wild cherry, hickory, and bayberry).

The willow leaf beetles, RÖRIG (*Illus. Ztschr. Ent., 2 (1897), No. 42, pp. 657–661*).—More or less of the life history of *Chrysomela vulgatissima*, *Phratora vitellinæ*, *P. cærulescens*, and *Gabruca capreæ* is discussed.

Injurious insects, A. ACLOQUE (*Paris: Felix Alcan, p. 192, figs. 67; rev. in Zool. Centbl., 4 (1897) No. 26, p. 917*).

The egg sacs and larvæ of some grasshoppers (Acridiidæ) J. INGENITZKY (*St. Petersburg, 1896, pp. 8, ill.; rev. in Zool. Centbl., 4 (1897), No. 26, pp. 917, 918*).—The egg sacs of some West Siberian Acridiidæ affecting grains.

The injurious animals of our cultivated plants, III (*Deut. Landw. Presse, 24 (1897), No. 59, p. 540*).—Short notes on several Lepidoptera.

The small lepidopterous genus Lithocollitis, II, C. SCHROEDER (*Illus. Ztschr. Ent., 2 (1897), No. 40, pp. 625–629, figs. 7*).

The distribution of Lepidoptera, PREHN (*Illus. Wchnschr. Ent., 2 (1897), No. 20, pp. 305–309; 21, pp. 332–334, maps 3*).

A little-known birch enemy, SCHENKLING-PRÉVÔT (*Illus. Ztschr. Ent., 2 (1897), No. 42, pp. 661–664, pl. 1*).—*Incurvaria tumorifica*. The eggs of this moth are laid at the axils of the leaves or where a new twig is starting—one at a place. The larva lives in the adjacent tissue, producing a swelling so that affected twigs have a knotted appearance. The moth is somewhat rare and was first noted by Amerling at Prag.

A new grapevine disinfectant, B. H. RIDGELY (*U. S. Consular Rpts., 1898, No. 209, pp. 267–269*).—A brief note is given of a new compound called phylloxerol, used in Switzerland with good effect against the phylloxera. It has the double effect of destroying the insects and of acting as a fertilizer. It may be applied to other plants as well as to the vine. In the case of the vine a small hole is scooped out around the vine and in it 8.3 to 12.5 ozs. of the phylloxerol placed and the earth filled in again. This operation is repeated in the spring. According to the manufacturer[1] about 55 lbs. of the substance is sufficient for 1 acre of vines for 2 or 3 years.

Destruction of locusts, L. BERGHOLZ (*U. S. Consular Rpts., 1898, No. 209, pp. 269, 270*).—The destruction of locusts by arsenic poisoning in Natal is noted. The poison consists of arsenite of soda made by dissolving 1 lb. caustic soda in 4 gal. of boiling water and adding 1 lb. of arsenic. To this 8 gal. of hot or cold water, and 20 lbs. of brown sugar are added; or by mixing it with 10 gal. of treacle. Bunches of corn, grass, etc., dipped in the mixture are placed along the roads where the locusts can get them.

FOODS—ANIMAL PRODUCTION.

Report of preliminary investigations on the metabolism of nitrogen and carbon in the human organism, W. O. ATWATER, C. D. WOODS, and F. G. BENEDICT (*U. S. Dept. Agr., Office of Experiment Stations Bul. 44, pp. 64, figs. 4*).—These investigations were made at Wesleyan University, Middletown, Connecticut, by the Connecticut Storrs Station in coöperation with this Department. They have been briefly reported in previous publications.[2] The object was to determine the income and outgo of matter and energy. The balance of matter is expressed in terms of nitrogen and carbon. The determination of the balance of hydrogen was also attempted, but the results obtained and the measurements of the heat given off by the body are not reported. Proximate and elementary analyses were made of the food, urine, and feces, and their fuel value was determined with a bomb calorimeter. The respiratory products were measured and analyzed, the amount of carbon dioxid and water being determined. In connection with the experiments, the apparatus used was modified and improved and experimental methods were elaborated. For the measurement of the respiratory products and energy of the body a respiration calorimeter of special construction was devised.

The inside dimensions of the respiration chamber are 2.15 by 1.22 by 1.92 meters, and the volume approximately 4.8 cubic meters. The chamber consists of 3 concentric boxes, the inner one of metal and the two outer ones of wood. The inner box, or chamber, is double walled, the inner wall being of sheet copper, the outer of sheet zinc. The 2 walls are 8 cm. apart. An opening in the front end of the metal

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[1] Eugene Courvoisier (Versoix, Canton of Geneva, Switzerland).

[2] Science, 5 (1897), No. 117, pp. 493–496 (E. S. R., 8, p. 821); Connecticut Storrs Sta. Rpt. 1896, p. 85.

chamber serves both the purpose of a window and a door for entrance and exit.

A current of air is pumped through the apparatus and measured by special devices. Samples of the incoming and outgoing air are taken for analysis.

An inconvenient rise of temperature is prevented by a current of cold water which passes through a system of pipes inside of the chamber. This device forms a part of the arrangements for measuring the heat given off from the body.

It is desirable to have the incoming current of air as dry as possible. To reduce the water content to a minimum the air which came from out of doors was dried before it entered the chamber by surrounding a portion of the pipe through which it passed with a freezing mixture of salt and ice. The amount of water remaining in the incoming air and that in the outgoing air was determined by passing the sample through U tubes filled with pumice stone saturated with concentrated sulphuric acid. The carbon dioxid in the samples of air was determined by passing the air through tubes filled with soda lime. A U tube, containing glass beads drenched with barium hydroxid solution, was also used as a control.

A full description of the different parts of the apparatus is given, and the methods followed in conducting a metabolism experiment are described in detail.

The subjects of the experiments were a laboratory janitor, a chemist, and a physicist, all young men in good health. The food consisted of a simple mixed diet, which in every case was selected in accordance with the dietary habits of the subject. Two tests were made with the laboratory janitor. In each the subject remained in the respiration chamber $2\frac{1}{3}$ days, although the digestibility of the food was determined for a longer period ($4\frac{2}{3}$ days). In the experiment with the chemist the subject remained in the respiration chamber 5 days, and the digestion experiment, which covered several days before the subject entered the respiration chamber, was of $8\frac{1}{3}$ days' duration. In these tests the subjects performed no muscular work, and spent their time in reading or resting.

The experiment with the physicist was of longer duration than the preceding, the subject remaining in the respiration chamber 12 days. The digestibility of the food was determined on several days before the subject entered the chamber and during the experiment, making $16\frac{2}{3}$ days in all. The respiration experiment was divided into 5 periods. The first and fifth periods were of $1\frac{5}{8}$ and $1\frac{3}{8}$ days' duration, respectively, and were regarded as preliminary and supplementary. The subject avoided both muscular and mental work as much as possible. The remaining periods were each of 3 days' duration. The second was devoted to severe mental labor; the third was spent in absolute rest, the subject avoiding as far as possible all mental and physical exercise; and the fourth was a period of quite severe muscular activity. The subject spent 3 hours each day in raising and lowering a 5.7 kg. iron weight by means of a pulley.

The income and outgo of nitrogen and carbon and the fuel value of the food, urine, and feces are recorded in full for each of the experimental periods. In the following table the results for the balance of income and outgo of nitrogen and carbon are summarized:

Income and outgo of nitrogen and carbon.

	Nitrogen.				Carbon.				
	In food.	In urine.	In feces.	Gain (+) or loss (—).	In food	In urine.	In feces.	In respiratory products.	Gain (+) or loss (—).
	Gms.	*Gms.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*
Laboratory janitor: Rest (2 days)	45.4	39.2	1.8	+ 4.4	578.6	22.7	18.0	428.2	+109.7
Do	38.4	36.1	3.2	— 0.9	521.2	28.6	19.8	435.1	+ 37.7
Chemist: Light mental work (5 days)	76.5	68.7	4.5	+ 3.3	171.5	54.6	34.5	1,099.6	— 17.2
Physicist:									
Rest (1⅝ days)	26.3	23.2	2.3	+ 0.8	396.7	13.5	17.1	376.2	— 10.1
Mental work (3 days)	48.6	39.4	4.2	+ 5.0	732.3	26.3	31.5	696.6	— 22.1
Rest (3 days)	48.6	37.4	4.2	+ 7.0	732.3	32.2	31.5	713.2	— 44.6
Muscular work (3 days)	48.6	42.4	4.2	+ 2.0	732.3	30.1	31.5	1,114.6	—443.9
Rest (1⅜ days)	22.3	21.5	1.9	— 1.1	335.6	17.2	14.4	336.6	— 32.6
Whole experiment (12 days)	194.4	163.9	16.8	+13.7	2,929.2	119.3	126.0	3,237.2	—555.3

From the income and outgo of nitrogen and carbon the gain or loss of protein and fat was calculated.

"The experience here obtained emphasizes the desirability of longer experimental periods than have been customary in experiments of this class. Although a considerable number of respiration experiments have been made with animals and man, the periods have rarely exceeded 24 hours.

"The prospects for obtaining a satisfactory balance of income and outgo of energy are, on the whole, decidedly encouraging. The determinations of heats of combustion by the bomb calorimeter are eminently satisfactory, and there seems to be good ground to hope that ultimately the measurements of heat given off from the body may also prove sufficiently accurate for such purposes. . . . Experience in this laboratory since the above experiments were made have yielded results agreeing very closely, indeed, with the theoretical figures.

"The results of these experiments and of similar investigations elsewhere bring out very clearly the difference in the amounts of nutrients and energy required by the organisms of different persons under different conditions, and confirm the results of previous inquiry in showing that muscular labor is performed at the expense of the fats, sugars, and starches. They also make it clear that the body may draw upon protein for this purpose, although it has not yet been determined just what are the conditions under which this is done."

The chemistry of the corn plant, F. T. SHUTT (*Canada Expt. Farms Rpts. 1896, pp. 208–211*).—Analyses are reported of a number of varieties of corn (whole plant) in the following stages of growth: Tasseling, silking, early milk, late milk, and glazing. The amounts of the different constituents per ton and per acre furnished at the different periods of growth are also computed. Using the ordinarily accepted coefficients of digestibility, the author computed the digestible matter per ton and per acre as follows:

Digestible matter in corn fodder at different stages of growth.

Stage of growth.	Digestible matter in one ton.	Digestible matter per acre.
	Pounds.	*Pounds.*
Tasseling	186.2	4,220
Silking	211.0	5,069
Early milk	256.5	5,873
Late milk	285.9	6,012
Glazing	339.2	7,308

Among the conclusions reached were the following: "Cutting the corn before it reaches the glazing condition—a practice quite common a few years ago—is not to be advised, since in the later stages of the plant's growth there is a large gain in food constituents. . . . The mineral constituents (ash) are taken by the plant from the soil more particularly during its early stages of growth." As the plant matures the amount of nonalbuminoid nitrogen decreases while the albuminoid nitrogen increases. The percentage of carbohydrates also increases as the plant approaches maturity.

Analyses of fodders and feeding stuffs (*Maine Sta. Rpt. 1896, pp. 28, 29*).—Analyses are reported of the following feeding stuffs: Sunflower (heads and whole plant); English horse beans; silage from mature corn, sunflower heads, and horse beans; corn planted at 6, 9, and 12 inches; King gluten meal; potato pomace, and black grass (*Juncus gerardi*). The composition of a number of these is given in the following table:

Analyses of feeding stuffs.

	Water.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Sunflower heads	86.07	1.93	1.49	5.62	3.79	1.10
Sunflower, whole plant	85.21	1.70	1.03	6.14	4.00	1.92
English horse beans	82.65	3.88	.49	7.18	3.71	2.09
Silage—mature corn, sunflower heads, and horse beans (average of 4 analyses)	69.69	3.97	1.88	16.71	6.13	1.62
Potato pomace	10.96	6.56	.52	68.99	10.26	2.71

Sunflowers and English horse beans as silage crops, J. M. BARTLETT (*Maine Sta. Rpt. 1896, pp. 32–34*).—For several seasons sunflowers and horse beans have been grown at the station for silage. The crops were harvested in the early part of September, run through a silage cutter, and mixed with corn in the silo in the following proportion: One-fourth acre of sunflowers, one-half acre of horse beans, and one acre of corn. In half the silage the whole sunflower plant was cut up and in half the heads only. Both mixtures were well preserved, and when opened in January were greedily eaten by cows. Although the stalks of the sunflowers were large and coarse, the silage was eaten as readily as that made from corn alone. The cost of growing the sunflowers and horse beans was estimated to be about the same as that of corn. Analyses of these plants are given above. The yields follow:

Yield per acre of sunflowers and English horse beans.

	Weight as harvested.	Weight of dry matter.
	Pounds.	*Pounds.*
Sunflower heads	27,040	3,767
Sunflower, whole plant	48,800	7,219
English horse bean, whole plant	20,160	3,497

Though the sunflower is a prolific crop, the chemical composition is about the same as that of southern corn grown in Maine. The author does not regard it as a desirable fodder plant when corn can be successfully grown, on account of the coarse, rough stalks and leaves, which render the plant somewhat unpalatable. It would doubtless be largely rejected by stock unless it were ensiled. The fact is pointed out that ensiling prevents the waste of the coarse material which is ordinarily thrown away.

Horse bean was found a satisfactory feeding stuff, though at present prices the author believes it to be more economical to raise the needed corn for coarse fodder and to purchase the concentrated feeds necessary for making up the ration.

The feeding value of broken hop vines, F. T. SHUTT (*Canada Expt. Farms Rpts. 1896, p. 216*).—Analysis of hop vines showed the following composition: Water 8.69 per cent, protein 2.53 per cent, fat 0.7 per cent, carbohydrates 33.31 per cent, fiber 50.16 per cent, and ash 4.61 per cent. The sample analyzed is described as being exceedingly woody. In the author's opinion hop vines are inferior to straw as a feeding stuff. Unless well soaked and fermentation induced, the sharp fragments would probably prove injurious. On account of their fertilizing value it is recommended that hop vines be composted, or, if they are too woody for this treatment, that they be burned for their ashes.

Lacteo-vituline (**calf meal**), F. T. SHUTT (*Canada Expt. Farms Rpts. 1896, pp. 214–216*).—Lacteo-vituline is a feeding stuff prepared in France, and recommended for calves as a substitute for milk. It was found to contain 9.87 per cent water, 16 per cent protein, 8.38 per cent fat, 61.68 per cent carbohydrates, 1.17 per cent fiber, and 2.90 per cent ash, chiefly phosphates, chlorids, and silicates (of calcium, sodium, and potassium). This feeding stuff is compared with cows' milk. The fact is pointed out that it is 2½ times as costly.

Relative digestibility of cheat and clover, G. W. SHAW and H. T. FRENCH (*Oregon Sta. Bul. 47, pp. 8, pl. 1*).—A test was made with a steer to compare the digestibility of cheat and clover. After a preliminary feeding period of 2 weeks the digestion experiment proper began and lasted 6 days. The amounts of food and water consumed are recorded and analyses are reported of the cheat and clover hay eaten and of the dung. The coefficients of digestibility of the clover hay were as follows: Dry matter 62 per cent, protein 63, ether extract 55, nitrogen-free extract 71, crude fiber 59, and ash 37. The figures for cheat hay were as follows: Dry matter 45 per cent, protein 42, ether extract 32, nitrogen-free extract 49, crude fiber 46, and ash 23.

The composition of package tea, J. A. WIDTSOE (*Utah Sta. Rpt. 1897, pp. 31, 32*).—Analyses are reported of 5 samples of tea sold in packages and regarded as typical of that ordinarily sold in the State. The composition of the different samples was as follows:

Composition of package tea.

	Water.	Nitrogen.	Thein.	Ash.	Material soluble in water.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Black	5.41	4.15	3.38	5.67	54.50
Green, faced	6.64	3.63	2.88	6.57	55.48
Do	7.97	3.96	3.02	6.76	54.41
Do	6.90	4.10	2.18	6.34	55.10
Do	5.74	3.83	3.29	6.41	55.79

The black tea was apparently uncolored. The green teas were colored or faced.

Feeding steers, 1895–'96, W. SAUNDERS (*Canada Expt. Farms Rpts. 1896, pp. 80–84*).—A test was made with 3 lots of 4 steers each to compare a number of coarse fodders as part of a ration. The test was divided into 3 periods of 6, 8, and 6 weeks, respectively. The feeding experiment proper was preceded by a preliminary period of 6 weeks. The steers were fed the following basal rations per head per day:

Lot 1, 50 lbs. silage, 25 lbs. turnips, 5 lbs. hay.
Lot 2, 25 lbs. corn fodder, 25 lbs. turnips, 5 lbs. hay.
Lot 3, hay and turnips *ad libitum* (about 20 lbs. hay and 50 lbs. turnips).

The silage consisted of corn, horse beans, and sunflower heads in the proportion of 10 : 2½ : 1.

In addition to the basal ration lot 1 was fed per head daily during the second period 2 lbs. of meal and during the third period 4 lbs. of meal, and lots 2 and 3 during the first period 4 lbs. and during the second and third periods 6 lbs. of meal. The meal consisted of equal parts of barley, wheat, peas, bran, and oil cake. The average weight of the steers at the beginning of the test was about 1,000 lbs. The financial statement is based on silage at $2.50, turnips at $2, hay at $8, corn fodder at $4, and meal at $20 per ton. The results are reported in detail.

"From these tests it appears that the 4 steers fed on ration 1 gained in all during the feeding period 831 lbs. at a cost of $6.49 per 100 lbs. The 4 steers fed on ration 2 gained in all during the feeding period 685 lbs. at a cost of $9.92 per 100 lbs., while the 4 steers fed on ration 3 made a total gain of 693 lbs. at a cost of $9.83 per 100 lbs.

"Taking the cost per day, each animal in group 1 was fed at a cost of 9.53 cts. per day; group 2, at a cost of 12.18 cts., and group 3, at a cost of 13.53 cts. each per day.

"During the feeding period of 20 weeks, the steers fed on ration 1 gained, on the average, 36½ lbs. per head more and cost 2.65 cts. less per head per day for the feed consumed than the steers which were fed on ration 2; and they gained 34½ lbs. per head more and cost 4 cts. per head less per day than the steers which were fed on ration 3. This appears to show that of the 3 rations used in these experiments, No. 1 was the most profitable."

Feeding steers, S. A. BEDFORD (*Canada Expt. Farms Rpts. 1896, pp. 348, 349*).—A test is reported, made at the experimental farm at Brandon, with 2 lots of 2 steers each, to study the value of turnips as part of a ration. The test continued 147 days. Both lots were fed the same quantities of cut straw and chopped wheat, barley, and oats. One lot was fed turnips in addition. The results are given in tabular form.

In the author's opinion it would appear that at the prevailing prices for grain turnips were fed at a loss. "This, however, is contrary to the general experience of skilled feeders throughout the Dominion, and further and more extensive experiments would be needed before such a conclusion could be accepted."

Experiments with cattle, A. MACKAY (*Canada Expt. Farms Rpts. 1896, pp. 416, 417*).—Tests made at the experimental farm at Indian Head are reported with 5 lots of cattle, to compare a number of coarse fodders. Lot 1 was fed 15 lbs. hay, 5 lbs. straw, 5 lbs. mixed meal, and 20 lbs. turnips; lot 2, 30 lbs. corn silage, 10 lbs. straw, 5 lbs. meal, and 20 lbs. turnips; lot 3, 15 lbs. cut oat sheaves, 20 lbs. corn silage, 5 lbs. meal, and 20 lbs. turnips; lot 4, 20 lbs. corn silage, 8 lbs. hay, 10 lbs. straw, 5 lbs. meal, and 20 lbs. turnips; and lot 5, 15 lbs. cut oat sheaves, 5 lbs straw, 5 lbs. meal, and 20 lbs. turnips. The meal consisted of wheat screenings and barley.

Lots 1, 2, and 3 were made up of 2 steers each, lot 4 of 2 cows, and lot 5 of a bull and a steer. The first 4 lots were fed for 5 months and the last for 4 months. The total gains made by the different lots were as follows: Lot 1, 555 lbs.; lot 2, 480 lbs.; lot 3, 480 lbs.; lot 4, 447 lbs.; and lot 5, 370 lbs.

Notes on the cattle show of the Smithfield Club, G. ROGERS (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 326–331*).—The article contains a record of the live and dressed weights of a number of steers exhibited at the Smithfield Club show, together with the weights of the head, tail, hide, and internal organs. The animals were exhibited alive, and after slaughtering the carcasses were judged for the awarding of prizes. Awards were made on the quality of meat, the proportion of fat to lean in the most valuable parts, the ratio of live weight to dressed weight, and other minor details.

"The deductions that have been made in England from the results of this competition have led to a great amount of discussion on the subject of the profitable fattening of stock. A knowledge of the opinions expressed may be made a source of profit to all who cater to the English trade.

"To appreciate the discussion fully it must first be understood that the typical beef, according to the English taste, consists of a great depth of well-marbled lean flesh. With this fact in mind one can readily see that an inevitable conclusion from the tabulated results of the competition was that the superabundance of fat, which makes the living animal so attractive to the eye of the breeder, is a certain source of waste and loss to the butcher who buys the animal for slaughter and the profits of English trade."

Pig feeding, J. L. HILLS (*Vermont Sta. Rpt. 1896–'97, pp. 34–43*).—In continuation of work previously reported (E. S. R., 8, p. 1012) a test was made with 12 pigs to compare the feeding value of corn meal and whole corn and skim milk, and corn meal with whey and wheat bran, and to learn whether skim milk is most profitably fed in large or small quantities. The test was divided into 4 periods of 45, 43, 36, and 62 days each. The pigs were divided into 4 lots of 3 each. Lot 1 was fed 6 qt. of skim milk and 12 oz. of corn meal daily; lot 2 was fed the same quantity of skim milk and 12 oz. of shelled corn; lot 3 was fed 1 oz. of corn meal to a quart of skim milk, the amount being increased to 12 qt. of milk and 24 oz. of corn meal; lot 4 was fed 12 oz. of bran with whey in increasing amounts until 12 qt. was fed daily. During part of the test lots 3 and 4 were fed an additional quantity of corn meal, or corn meal and bran, 1 : 1.

The financial statement is based on skim milk at 15 cts. and whey at 9 cts. per 100 lbs. and corn meal and bran at $14 and $12 per ton, respectively. The total cost of the food eaten was $112.74, leaving as a profit but $2.55.

The foods consumed and the gains made by each pig are given in tabular form. The pigs were slaughtered and sold for 4½ cts. per pound, dressed weight. The weights and percentage of shrinkage are recorded. The average results of the test are shown in the following table:

Results of pig feeding.

	Average weight at beginning of test.	Average live weight at end of test.	Shrinkage in dressed weight.	Dry matter eaten per pound of gain.	Cost of food per pound of increase (dressed weight).	Total profit (+) or loss (—) per pig.
	Pounds.	*Pounds.*	*Per cent.*	*Pounds.*	*Cents.*	
Lot 1 (corn meal and skim milk)	41	308	14	4.14	4.02	+$1.12
Lot 2 (shelled corn and skim milk)	41	289	17	4.54	4.42	+ .24
Lot 3 (corn meal and skim milk)	45	306	15	4.62	5.17	— 1.46
Lot 4 (wheat bran and whey)	40	277	17	4.32	4.09	+ .81

The author's conclusions are as follows:

"(1) Corn meal proved superior to shelled corn. It is doubtful, however, whether the gain was equal to the extra cost of grinding.

"(2) Whey in large quantities with bran proved a more economical feed than skim milk in large quantities with corn meal, but no more so than skim milk fed in small quantities with corn meal.

"(3) The economy of production was decidedly in favor of small rather than large quantities of skim milk.

"(4) Profits turned to losses as the average pig grew beyond 150 lbs., because of ow prices for pork and illiberal feeding during middle life.

"(5) Subtracting the cost of grain from the total receipts, allowing manure to offset care, skim milk was found to be worth 18 cts. (fed in small quantities), 12 cts. (fed in large quantities), and 15 cts. (average), while whey proved to be worth 11 cts. per hundred.

"(6) The foods contained fertilizing ingredients worth 54 per cent of their cost."

Experiments in the fattening of swine, W. SAUNDERS (*Canada Expt. Farms Rpts. 1896, pp. 84–89*).—In continuation of previous work[1] tests were made with 10 lots of 3 to 5 crossbred pigs to compare the value of a number of feeding stuffs. The feeding periods were from 12 to 20 weeks' duration. Sunflower heads and grain were compared with 2 lots, pulped raw potatoes and cooked potatoes with 5 lots, and ground oats and peas and a mixture of the two with 3 lots. In every case skim milk and mixed grain were fed also. The grain in weight made by the different lots and the shrinkage of the carcass on slaughtering are recorded in tabular form.

In the comparison of grain and sunflower heads lot 1, consisting of 5 pigs, was fed for 18 weeks grain *ad libitum* soaked in water for 30 hours and 6 lbs. of skim milk per head daily. Lot 2, consisting of 5 pigs, was fed for the same length of time half as much grain, sunflower heads *ad libitum*, and 6 lbs. of skim milk per head daily. The grain consisted of a mixture of ground barley, rye, wheat, and bran. The following table gives the results of the comparison of sunflower heads and grain:

Results of feeding sunflower heads and grain to pigs.

	Weight at beginning.	Weight at close.	Shrinkage in dressed weight.	Food consumed per pound of gain.		
				Milk.	Grain.	Sunflowers.
	Pounds.	*Pounds.*	*Per cent.*	*Pounds.*	*Pounds.*	*Pounds.*
Lot 1 (ground grain and skim milk)	299	932	22.21	4.35	3.10	....
Lot 2 (ground grain, skim milk, and sunflower heads)	305	828	25.60	5.40	1.92	2.11

No general deductions are drawn from the experiments.

The value of dairy by-products in pig feeding, F. B. LINFIELD (*Utah Sta. Rpt. 1897, pp. 59, 60*).—A preliminary report is given of a test of the value of skim milk, made with 3 lots of 3 pigs each. Lot 1 was fed skim milk and chopped wheat, 5 : 1, until the pigs averaged 75 lbs., and then in the proportion of 3 : 1; lot 2, skim milk *ad libitum;* and lot 3, chopped wheat mixed with water *ad libitum*. The milk was fed fresh or sour. Lots 1 and 2 received some whey with the skim milk.

The test began January 16 and covered 100 days. The food consumed and the gains made are reported and the value of the foods is discussed, reckoning the gain in weight at 3 cts. and at 4 cts. per pound.

"The gain per day for each hog fed on milk and grain was 2.54 times greater than for those fed on milk alone, and 1.7 times greater than

[1] Canada Expt. Farms Rpts. 1895, p. 191 (E. S. R., 8, p. 921).

those fed on grain alone. The value of the skim milk when fed in combination was 75 per cent greater than when it was fed alone."

Experiments with swine, S. A. BEDFORD (*Canada Expt. Farms Rpts. 1896, p. 350*).—A brief report is given of a pig-feeding experiment carried on at the experimental farm at Brandon to compare wheat with mixed grain. Three pigs were fed soaked wheat, and 3 a mixture of ground soaked wheat, barley, and oats, 2 : 1 : 1. The pigs fed wheat weighed 155 lbs. at the beginning of the test, and during 6 months gained 355 lbs., consuming 4½ lbs. of wheat to a pound of gain. The pigs fed mixed grain weighed 150 lbs. at the beginning and during the 6 months gained 311 lbs., consuming 5½ lbs. of grain per pound of gain.

In the author's opinion, if the manure be considered an equivalent for the labor of feeding and caring for the pigs and pork be rated at 4 cts. per pound live weight, the wheat would be worth 88 cts. per hundred and the mixed grain 72 cts.

Investigations on bread for soldiers, PLAGGE and LEBBIN (*Untersuchungen über das Soldatendrot. Berlin: A. Hirschwald, 1897, pp. viii, 234*).—This volume, which is No. 12 of *Veröffentlichen aus dem Gebiete des Militar-Sanitätswesens*, contains an investigation of different methods of grinding grain, suggestions for improving bread for soldiers, experiments on milling, digestion experiments (with man) with different kinds of bread, a review of earlier investigations on bread, and a bibliography. In an appendix a considerable number of digestion experiments (with man) with "Aleuronat biscuits" and other similar products are reported.

Frankfurter sausage, fresh and canned, G. POPP and C. FRESENIUS (*Ztschr. Öffentl. Chem., 3 (1897), p. 155; abs. in Vrtljschr. Chem. Nahr. u. Genussmtl., 12, No. 2, pp. 155, 156*).—The article contains analyses of fresh and canned Frankfurter sausages.

Fish flesh from a hygienic standpoint, P. O. SMOLENSKI (*Hyg. Rundschau, 7 (1897), Nos. 22, pp. 1005–1121; 23, pp. 1166–1180; 24, pp. 1226–1247*).—This is a translation by the author of his paper, published first in Russian. The use of fish as food is discussed at length and the results of many investigations are quoted. The article includes a compilation of analyses of fish and fish products, including many from Russian sources, as well as dietaries in which fish formed the sole or principal animal food consumed. A bibliography of the subject is given.

Canned goods colored with copper, S. FERENCZI (*Ztschr. Nahr. Untersuch. u. Hyg., 11 (1897), No. 21, pp. 346–348*).—A discussion of the work of E. Schunck and of Tschirch.

Composition and value of foods, J. KÖNIG (*Procentische zusammensetzung und Nährgeldwerth der menschlichen Nahrungsmittel. Berlin: J. Springer, 1897; rev. in Ztschr. Nahr. Untersuch. u. Hyg., 11 (1897), No. 23, pp. 403, 404*).—A colored chart showing the composition and digestibility of important foods and the nutrients in dietary standards.

Composition of Utah feeding stuffs, J. A. WIDTSOE (*Utah Sta. Rpt. 1897, pp. 32–34*).—Compiled analyses of a number of feeding stuffs made at the station, most of which have been previously published.

The relative feeding value of certain root crops, F. T. SHUTT (*Canada Expt. Farms Rpts. 1896, pp. 211, 212*).—Analyses are reported of Pomeranian White Globe, Elephant Purple Top, and Green Top Yellow Aberdeen turnips.

The practical use of molasses feed, STRUBE (*Bl. Zuckerrübenbau, 1897, No. 11, p. 172; abs. in Centbl. Agr. Chem., 26 (1897), No. 12, pp. 805, 806*).—Molasses feeds prepared with palm-nut cake and with peat are described and their composition given. From personal observation the author recommends molasses feed for horses, oxen, and cows.

Dried brewers' grains, H. P. ARMSBY (*Pennsylvania Sta. Rpt. 1896, pp. 53, 54*).—Analyses are reported of 2 samples of dried brewers' grains. These are compared with analyses reported by the New Jersey Station.

Oil-cake meal and germ meal, F. T. SHUTT (*Canada Expt. Farms Rpts. 1896, pp. 212–214*).—Oil-cake meal and germ meal are described and analyses of samples reported.

Miscellaneous fodder crops, J. L. HILLS (*Vermont Sta. Rpt. 1896–'97, pp. 188–190*).—Analyses are given of red clover rowen, mammoth red clover rowen, alsike clover rowen, white clover rowen, flat pea, vetch and oats, green soy bean, alfalfa, millets, Hungarian grass, Kafir corn, white mustard, endive, and Swiss chard, with remarks upon the value of some of these.

General observations on oats, BALLAND (*Jour. Agr. Prat., 2 (1897), No. 44, pp. 681, 682*).—A discussion of the feeding value of oats. The chemical composition of different crops of oats is given to show how the different constituents vary.

The composition of preserved egg yolk, F. JEAN (*Monit. Sci., 4. ser., 6 (1897), p. 561; Ztschr. Analyt. Chem., 36 (1897), p. 406; abs. in Vrtljschr. Chem. Nahr. u. Genussmtl., 12, No. 2, p. 162*).

The composition of white of egg, A. PANORMOFF (*Rev. Internat. Falsif., 10 (1897), p. 27; abs. in Vrtljschr. Chem. Nahr. u. Genussmtl., 12, No. 2, p. 162*).

The use of aseptics in food materials, F. JEAN (*Jour. Hyg., 22 (1897), No. 1109, pp. 607, 608; 23 (1898), No. 1011, pp. 10–12*).—An address before the Société Français d' Hygiène.

The preservation of eggs and the production of eggs rich in iron and phosphorus, L. BERNEGAU (*Pharm. Ztg., 42 (1897), p. 381; abs. in Vrtljschr. Chem. Nahr. u. Genussmtl., 12, No. 2, p. 161*).

The curing of meats (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 97–108*).—The process of curing Smithfield hams is described at length as well as the methods followed by a number of packing houses in curing beef, ham, mess pork, dry salted backs, etc.

Foods, hygiene, and dietary standards, H. CATHELINEAU and A. LEBRASSEUR (*Des aliments, hygiene, et régimes alimentaires. Paris: Ruell & Co., 1897; rev. in Jour. Hyg., 22 (1898), No. 1014, p. 48*).—In addition to general discussion, this volume contains tables of analyses of a number of foods with dietaries suited to persons of different ages and occupations.

Dietary studies at the Maine State College (*Maine Sta. Rpt. 1896, pp. 128–140*).—This is a brief account of work reported in Bulletin 37 of this Office (E. S. R., 9, p. 162).

On the condition of the protein in resting and working muscles, D. I. KURAEV (*O Byelkorom Sostoyanii Muishtz Pokoïnuikh ī Dyeyatelunnikh. Inaug. Diss., St. Petersburg (Russian), 1896, pp. 204*).—A large number of experiments were made with isolated muscles of frogs and rabbits. The work is described and discussed in detail. The author believes with Pflüger that there is in the muscles a reserve substance of unknown composition which by its cleavage performs work. This is neither sugar, nor fat, nor ordinary protein, but is living matter. Fat and carbohydrates in one way or another enter into the living protoplasm and thus participate in the production of mechanical work. The rôle of the fats and carbohydrates is very important and perhaps essential. The author's principal deduction is that living tissue of muscle, *i. e.*, the proteid bodies it contains, must necessarily take part in the production of mechanical work.

The computation of rations for farm animals, H. P. ARMSBY (*Pennsylvania Sta. Rpt. 1896, pp. 18–52, pls. 2*).—This includes a discussion of the general principles of feeding, computation of rations, and the composition, digestibility, and fertilizing value of a number of feeding stuffs, as well as the percentage composition of the bodies of sheep, steers, and pigs.

The use of sugar in cattle feeding, A. PETERMANN (*L'Ing. Agr. Gembloux, 1897, p. 538; abs. in Centbl. Agr. Chem., 27 (1897), No. 1, pp. 43–45*).—The author discusses some of the recent work on feeding molasses and reports analyses of feeding stuffs prepared from extracted beet chips and molasses.

Fattening calves with skim milk and peanut oil, MINNA PETERSEN (*Milch Ztg., 26 (1897), No. 25, pp. 397, 398, figs. 3*).—A general article.

Skim milk and starch for fattening calves, A. GOUIN (*Milch Ztg., 26 (1897), No. 31, pp. 493, 494*).—A popular article quoted from *Jour. Agr. Prat.*

Experiments with swine, A. MACKAY (*Canada Expt. Farms Rpts. 1896, p. 417*).—A test was made at the experimental farm at Indian Head with 2 Yorkshires, 2 Tamworths, and 2 crossbred pigs, to compare the gains made by the different breeds. The ration is not stated. The Yorkshires and Tamworths were about 4 months old at the beginning of the test and the crosses about 3 months old. They were all fed for 111 days. The Yorkshires gained 280 lbs., the Tamworths 315 lbs., and the crossbred pigs 304 lbs.

Pigs, breeds, and management, S. SPENCER (*London: Vinton & Co., 1897, pp. 180, pls. 19*).—A general treatise, with a chapter on the diseases of the pig by J. W. Axe and a chapter on bacon and ham curing by L. M. Douglas.

Poultry, S. A. BEDFORD (*Canada Expt. Farms Rpts. 1896, p. 351*).—Brief statistics are given of the poultry division of the Brandon experimental farm. The age and weight of the different breeds of poultry and the eggs obtained from each breed are recorded.

Report of the poultry manager, A. G. GILBERT (*Canada Expt. Farms Rpts. 1896, pp. 277–295, 415, figs. 7*).—Detailed plans for a poultry house are given. Among other subjects the following are discussed: The proper food and feeding of poultry, shortening the season of nonproduction, and the proper selection of breeding stock. Breeding experiments with a number of different varieties of chickens are briefly reported and statistics given of the laying stock and the number of eggs laid throughout the year. Wild geese were mated with Toulouse crosses. They did not agree and the eggs proved unfertile. Brief statistics are also given of the poultry kept and the rations fed at the Indian Head experimental farm.

Ducks and geese, G. E. HOWARD (*U. S. Dept. Agr., Farmers' Bul. 64, pp. 48, figs. 37*).—This bulletin discusses standard breeds of ducks and geese and their management.

DAIRYING—DAIRY FARMING.

The effect of various preparations of molasses on milk secretion, RAMM (*Landw. Jahrb., 26 (1897), No. 4–5, pp. 733–765*).—An experiment is reported at considerable length to study the effect of molasses-peat feed (80 per cent molasses and 20 per cent peat), liquid molasses, molasses, and palm-nut meal, molasses pulp (a dried mixture of potato-pulp residue and molasses), and molasses chips (a dried mixture of molasses and sugar-beet diffusion residue) in comparison with barley meal. A constant ration of hay, straw, and beets was fed. Eight cows were used, and the experiment covered 7 periods, usually of 20 days duration, only the last 5 days of each period being considered in making the averages. The method of making the different molasses preparations is described. The animals were weighed every other day. The yield and fat content of the milk were determined daily, and the sugar content was determined at frequent intervals. Several times in each period the milk of all the cows was churned and made into butter to test the quality. The detailed data for each of the cows are given, and from these data summaries are made of the averages for each period, the averages calculated to 1,000 kg. live weight, and the averages corrected for the natural decline with advancing lactation.[1]

The results with 2 of the cows were not considered normal, owing to digestive and other disturbances, and these were excluded in making up the averages. The average results for the 6 cows in each period are summarized below:

Average yield and composition of milk on different grain rations.

Period.	Grain feed per 1,000 kg. live weight.	Daily average.			Daily average per 1,000 kg. live weight.		
		Milk yield.	Fat content.	Total solids.	Milk yield.	Butter fat.	Total solids.
		Kg.	*Per cent.*	*Per cent.*	*Kg.*	*Kg.*	*Kg.*
1	8 kg. barley meal	17.075	3.109	11.780	32.866	1.02189	3.87403
2	8 kg. molasses-peat feed	14.131	3.156	11.782	27.233	.85382	3.19690
3	8 kg. fresh molasses	13.601	3.456	12.273	26.[illegible]38	.90416	3.22616
4	10 kg. molasses and palm-nut meal	12.614	3.379	12.242	24.478	.81830	2.93558
5	7 kg. molasses chips	12.770	3.621	12.528	24.811	.88446	3.08987
6	3.81 kg. molasses pulp	11.924	3.760	12.476	23.268	.85962	2.88314
7	8 kg. barley meal	13.575	3.689	12.592	26.654	.96296	3.33099

The different preparations of molasses were as a rule readily eaten, except in the case of the molasses pulp, which the cows did not appear to like well and refused to eat more than about half as much as of the other preparations. The molasses did not agree well with some of the cows. Only in the case of the liquid molasses was the whole quantity intended for each cow readily eaten. None of the molasses preparations appeared to be equal to barley meal for milk production. On the other hand, the author considers that the molasses feed favored an increase in the percentage of fat in the milk. The effect on the total solids was practically the same as on the fat.

With respect to the effect of the molasses preparations on the yield of milk, the molasses chips stood first, although the liquid molasses was nearly as advantageous. The sugar content of the milk did not appear to be affected by feeding molasses. The average sugar content of the milk of different cows showed only a maximum difference of 0.44 per cent. The butter made during the molasses feeding was in every way equal to that made on barley meal, and no difference was observed in the churning or the taste of the butter or the milk.

The 6 cows for which the data are given were likewise under experiment the year preceding (1895) and the average fat content of the milk

[1] In making this correction it was assumed that the difference between the production in the first and the last periods, during both of which barley meal was fed, represented the normal shrinkage due to advancing lactation; and that on a uniform ration the shrinkage from month to month would be regular. From this difference between the first and last periods the percentage of shrinkage was calculated (*i. e.*, the percentage relation of the total shrinkage to the production in the first period), and as the feeding covered 123 days this percentage of shrinkage was divided by 123, giving the percentage of shrinkage per day. With the aid of the latter the correction of the data for each period was made.

for each cow is compared with that in 1896. It is shown that in the case of every cow the milk was materially richer in fat in 1896 (when the molasses feed was fed), the average increase being 0.466 per cent. Compared with the first period, in which barley meal was fed, there was a gain in fat content of only 0.122 per cent over 1895. The author considers that the feeding of molasses preparations in 1896 increased the fat content during the period of feeding nearly 0.5 per cent over that in 1895. The relative fat content of the milk of individual cows in the 2 years was nearly the same, *i. e.*, in both years No. 1 gave the richest milk and the relative richness of the milk of the other cows was very nearly the same for both years.

Effect of molasses in comparison with cane sugar.—To determine whether the beneficial effect on the fat was due alone to the sugar in the molasses, an experiment was made with 2 cows covering 11 periods of 10 days each. Barley meal was fed in the first and the last 2 periods, and in other periods molasses peat feed and fresh molasses were compared with cane sugar fed alone and with palm cake and various salts (Kreuznach salts, potassium sulphate, and common salt). The results are given in detail for both of the cows. One of the cows shrunk rapidly in milk and was found later to be tuberculous. The results are briefly summarized in the following table:

Average results with barley meal, molasses, and cane sugar.

	Feed.	Milk.	Fat.	Total solids.
		Kg.	*Kg.*	*Kg.*
Average of periods 1 and 11	Barley meal	20.920	0.77364	2.61281
Average of periods 2 and 4	Molasses	19.172	.73372	2.43555
Average of periods 3 and 6	Cane sugar, without salts	16.948	.66508	2.20517
Average of periods 7, 8, and 9	Cane sugar, with salts	16.715	.66352	2.17841

The molasses was not quite equal to the barley meal, but was plainly superior to cane sugar. The addition of various salts to the cane sugar to approximate the salts contained in molasses appeared to have little, if any, effect on the relative results.

Feeding molasses to cows with calf.—Two cows in the last months of gestation were fed 8 kg. of molasses daily, per 1,000 kg. live weight, and after calving the feeding was continued. There was apparently no injurious effect from this feeding, either in the condition of the cow or the development of the calf.

In conclusion, the author expresses the belief that molasses is an advantageous, safe, and, at present local prices, cheap feeding stuff for milk production. Concerning the different forms, the experiments indicate the liquid molasses and the mixture of molasses and the residue from sugar-beet factories to be the best. Molasses-peat feed and molasses and palm cake have not given quite so favorable results, and the molasses pulp, while it gave good results, was not readily eaten by cows.

Studies of methods of experimental feeding trials, J. L. HILLS (*Vermont Sta. Rpt. 1896–'97, pp. 134–169, 193–217*).—This includes experiments on the proper length of feeding periods, the relative feeding value of rations with like nutritive ratios, the experimental error in feeding trials, and a comparison of Atlas gluten meal with other grain feeds. Full data are given in these experiments in the body of the article and in an appendix, and the results are summarized and discussed.

The proper length of feeding periods (pp. 146–161).—"So far as the writer can discover by thorough search and through consultation with others, no tests have been made showing what is and what is not a reliable period length. The short period of 1 or 2 weeks is clearly to be condemned as likely to furnish erroneous results, since the animal can hardly be said to have begun to feel the effects of the change in ration when the period is over. While such results are surely untrustworthy, it is not yet clear whether 3 or 4 weeks or more are necessary to furnish reliable data."

The experiments were made with 15 cows, divided into 5 lots of 3 each. Two different rations were fed containing corn meal and wheat bran with or without Atlas gluten meal. Lot 4 was alternated on these 2 rations for 6 periods of 4 weeks each, lot 5 for 5 periods of 5 weeks, lot 6 for 4 periods of 6 weeks, and lots 7 and 8 for 3 periods of 7 and 8 weeks, respectively. Owing to a misunderstanding lot 5 had to be reduced to periods of 4 weeks. The periods were divided into preliminary and experimental portions, the preliminary part of the period ranging from 10 days in the 4-week periods to 20 days in the 8-week periods. The nutritive ratio of the Atlas gluten meal ration averaged 1:6.6, and that of the other ration 1:10.2.

"It seems safe to assert that in these trials results essentially similar in character and extent were obtained when the Atlas ration was fed in periods from 6 to 8 weeks long as had been observed when it was fed for but 4 weeks. In other words, in this particular comparison, which it will be recollected is between a 'medium' and a 'wide' ration, feeding periods 4 weeks long gave trustworthy results as regards quantity changes. This deduction applies to the yield of milk alone and not to its quality. The effect of the Atlas ration upon the quality of the milk is considered under the next heading."

As to the effect of food on the quality of milk, an extensive résumé is given of experiments conducted in this country and abroad upon this subject, and the results in this particular experiment are summarized.

"When the Atlas ration of medium balance replaced the wide corn and bran ration for a short time (4 weeks or less) a somewhat richer milk was made, one in which the fat was increased and the solids not fat remained essentially unaffected. This effect was not observed, however, when the ration was fed 6 weeks or more, the quality remaining unaltered, or, if anything, growing a shade poorer. Nine cows fed in periods 4 weeks long testify that the quality of milk is slightly bettered, and the ratio of fat to solids not fat narrowed by the substitution of Atlas gluten meal for corn and bran in the ration. Eight other cows fed in periods from 6 to 8 weeks long testify to the contrary. . . . The upshot of these series of comparisons appears to be that the 4-week period did not give results which are entirely trustworthy touching the quality of the milk given on the Atlas ration. The 6-week period, however, and those yet longer in duration gave satisfactory results. Combining the conclusions on both quantity and quality, it would appear that a 4-week feeding period accurately indicated, in the present case. the character of and probably the extent of quantity changes, but that the slight improvement observed in quality was temporary and not to be relied upon as likely to continue under the conditions of prolonged feeding on a single ration. Since this latter effect is but slight and entirely without practical significance, and since the results of longer feeding discount it, one need not lose faith in the essential accuracy of past observations in which 4-week periods have been used."

The relative feeding values of 2 rations of equal balance (pp. 162–164).—In this experiment rations consisting of hay and silage, wheat bran, corn meal, and either 1½ lbs. each of cotton-seed meal and linseed meal or 4 lbs. of Atlas gluten meal were fed. The aim was to feed as nearly as possible the same amounts of digestible protein in the two rations, but, as a matter of fact, the amounts fed differed by about 5 per cent in favor of the oil-meal ration. The nutritive ratio of the oil-meal ration was 1:6.3 and of the Atlas meal ration 1:7.3. Nine cows were used in the experiment. They were alternated on the 2 rations for 5 periods, varying from 4 to 7 weeks each in length. Based on the 331 days of feeding, the following conclusions are drawn:

"Four per cent more dry matter eaten in the form of the Atlas ration than was eaten in the form of the cotton-seed-linseed ration produced 1 per cent more milk, but no more solids or fat. The milk made on the cotton-seed-linseed ration was somewhat the richer of the two, but the enrichment could hardly be termed one-sided, the ratio of fat to solids not fat narrowing very slightly (Atlas 1:1.71, cotton-seed-linseed 1:1.68).

"One hundred pounds of dry matter, both in the entire ration and in the grain portion thereof (experimental portion), proved more efficient in the cotton-seed-linseed than in the Atlas ration, making on the average about 6 per cent more product. This increase is not sufficient to warrant great stress being laid upon it, yet, because of the large number of cows used and the almost perfect uniformity of the trend in each individual case, it is thought that the difference lies outside the pale of possible experimental error and that it is mainly a food effect. The dry matter of the rations being of nearly equal digestibility (cotton-seed-linseed 75, Atlas 76), the conclusions in the last paragraph may properly be applied likewise to digestible dry matter.

"It has already been pointed out that the excess of protein in the cotton-seed-linseed ration was but 5 per cent. In these cases of essentially equal consumption of protein one ration proved somewhat more effective than another. The ration containing the most digestible carbohydrates, the most digestible fat, and the most digestible dry matter gave the smallest returns."

Experimental error in feeding tests (pp. 165–167).—

"The question has been raised whether differences obtained in feeding various rations, one against another, are not frequently due to causes other than changing food, even where every precaution is taken to render all other conditions uniform. In order to test this point a repetition of previous experiments made at this station, consisting of the uniform feeding of cows for several months, was carried out with 9 cows. Practically no change occurred in quantity or quality of product on a uniform ration. A pound of total dry matter produced as much milk, total solids and fat, at one time as at another, lactation stages being equalized. It is thought, however, that if but few animals are used it is unsafe to claim that changes in product of less than 5 per cent are of necessity due to changes in feeding."

Practical conclusions of economic value (pp. 167–169).—The above experiments afforded an opportunity for comparing Atlas gluten meal with corn meal and bran and with cotton-seed and linseed meal. The results are summarized below:

Comparisons of corn and bran, Atlas, and cotton-seed-linseed rations.

Ration.	Food eaten.						Production.		Cost of food.	
	Hay.	Corn meal.	Wheat bran.	Atlas gluten meal.	Cotton-seed-linseed meal (equal parts).	Silage.	Milk.	Butter.[1]	Per 100 lbs. of milk.	Per lb. of butter.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Cents.*	*Cents.*
Atlas meal	5,539	612	613	3,309	....	19,812	12,047	665	77.8	14.1
Corn and bran	5,231	2,166	2,166	....	....	18,781	10,152	557	84.7	14.9
Atlas meal	3,693	810	1,215	1,620	....	13,606	5,221	332	127.8	20.1
Cotton-seed-linseed meal	4,283	869	1,303	....	1,304	15,589	5,879	377	128.5	20.0

[1] One and one-sixth times the fat.

"The Atlas ration was more economical than the corn and bran ration. More milk was made thereon, and the food cost more; hence the milk was made but 8 per cent and the butter but 6 per cent cheaper on the richer ration. Atlas gluten meal at $16 is not much cheaper than corn and bran at $15 and $13, respectively.

"Apparently the cotton-seed-linseed ration made more milk and butter than the Atlas ration, and cost more. The periods, however, were of different lengths, and the animals were fed some 3 and some 5 periods; hence the figures are in reality useful only as means to arrive at the cost of food per unit of production. In this respect absolute equality is found. So far as can be judged under the somewhat irregular conditions of this test, the 2 rations were financially of equal value."

The fertilizing value of the different rations is considered.

Some observations on the relation between body conformation and production in cows, E. A. Bogdanow (*Jour. Landw., 45 (1897), No. 3–4, pp. 271–293, pl. 1*).—The author made various measurements on 80 cows of the herd at Tapiau, whose record for several years was known. The method of measurement followed was that described by Werner.[1] Various groups were formed according to the production of milk, butter, etc., and the measurements of the cows in the different groups were studied and compared.

From the results the author concludes that a close relation between external conformation and production is so apparent as to be unmistakable. Furthermore, so far as could be judged from special studies of early and late maturing cows, it appeared that the best yields were obtained from cows which matured relatively early.

Experiments on the effect of different grain and concentrated feeds on the milk production of cows, Ramm (*Landw. Jahrb., 26 (1897), No. 4–5, pp. 693–731*).—This experiment was with 2 lots of 5 cows each, and included trials of 18 different grain rations, each fed in addition to a basal ration of 14 kg. of hay, 6 kg. of straw, and 50 kg. of

[1] H. Werner, Rindzucht, Berlin, 1892.

beets per 1,000 kg. live weight. The grain feeds tested were rape cake, linseed meal, peanut cake, cotton-seed meal, sunflower meal, poppy cake, cocoanut cake, palm cake, dried brewers' grains, wheat meal, oatmeal, rye meal, corn meal, barley meal, wheat bran, rye bran, molasses and palm cake (1:1), and malt sprouts. With one lot the feeding commenced with the various meals and ended with the oil cakes, etc., and with the other the oil cakes were fed first. The periods were only 10 days each, except in 2 cases, with no transition periods intervening. Only the last 5 days were considered in studying the effect of the food. The rations usually contained about 2 kg. of digestible protein per 1,000 kg. live weight, although in a number of periods the amount dropped to 1.5 kg. and even lower. Consequently the nutritive ratios ranged from 1:6.5 to 1:12.4. The cows were weighed every other day and the yield and composition of the milk determined daily. The detailed data are tabulated.

The cows at first refused to eat the rye meal, but on the fifth day of the period commenced eating small amounts, the maximum consumption being about 12 kg. daily per 1,000 kg. live weight. The case was similar with rye bran, of which only 8.73 kg. was eaten.

The author found no relation between the fat content of the milk and the amount of fat contained in the rations, as has been suggested by Soxhlet (E. S. R., 8, p. 1016).

The author groups the feeding stuffs tested under three heads—those advantageous, those disadvantageous, and those indifferent in their effect on milk production. Among those advantageous to milk production were the mixture of beet molasses and palm cake, barley meal, malt sprouts, linseed meal, corn meal, wheat bran, and oatmeal in the order named. The mixture of molasses and palm cake had the greatest effect of any food on the solids and fat content. It was only disadvantageous to the increase in live weight. It is thought this may be due to the effect of the molasses on the kidneys, as suggested by Hagemann (see above). Barley meal was found a desirable food in every respect. On corn meal the yields of milk, solids, and fat were high, although the percentage of solids and fat was not noticeably high.

Among those disadvantageous to milk production were cocoanut cake, poppy cake, sunflower meal, peanut meal, cotton-seed meal, and rye bran. With cocoanut cake the results were unfavorable in almost every respect, due possibly to the fact that the animals ate only about half the amount which it was intended to give them. Poppy cake ranked poorest of all in respect to the fat and solids, both the percentage and the total amount. Sunflower meal, while not especially unfavorable, did not give satisfactory results. The peanut meal was especially disadvantageous to the content of solids and fat, while the yield of milk was only a little below the average. The same was true with cotton-seed meal, and in case of 2 of the cows inflammation of the udder was noticed. (About 3.6 kg. of cotton-seed meal per 1,000 kg.

live weight was fed.) The rape-seed cake, wheat meal, rye meal, palm cake, and dried brewers' grains had no particular effect upon milk production as a whole. The palm cake, although it gave a high percentage of fat, was not satisfactory in other respects. The milk had an oily odor and a pungent taste.

Feeding experiments with milch cows, J. M. BARTLETT (*Maine Sta. Rpt. 1896, pp. 37–55*).—In these experiments gluten meal was compared with cotton-seed meal, silage was compared with grain, and ground oats was compared with wheat bran, and the effect of Nutriotone was tested. Six registered Jersey cows were used, and these were divided into 2 lots of 3 each.

Gluten meal vs. cotton-seed meal (pp. 39–43).—Feeding a constant basal ration, 3 lbs. of gluten meal was compared with 2 lbs. of cotton-seed meal in 3 periods of about 3 weeks each. The composition of the feeding stuffs and of the milk, with other data, are tabulated.

"The data indicate that gluten meal is fully equal to cotton-seed meal when fed in sufficient quantity to make the amount of digestible nutrients equal in each ration. It is not equal to cotton-seed meal pound for pound as a source of protein, as it contains, on an average, about one-quarter less of that nutrient. It makes a very good quality of butter, but slightly softer than that made from cotton-seed meal ration when fed in the quantity used in this experiment."

Silage compared with grain (pp. 43–46).—The silage was the Robertson mixture, consisting of fodder corn, horse beans, and sunflower heads. Ration No. 1 consisted of 20 lbs. timothy hay, 20 lbs. silage, and 8 lbs. grain. Ration No. 2 consisted of 15 lbs. timothy hay, 35 lbs. silage, and 4 lbs. grain. There were 2 periods of 2 weeks each.

"This experiment, although too limited to be of much value in itself, confirms the results of Professor Robertson's investigations and those obtained from experiments made at this station last year, showing that silage of the quality used can be substituted in part for the grain ration of milch cows without causing loss of flesh or lessening the production of milk. In this case 15 lbs. of silage appeared to equal 4 lbs. of the grain mixture."

Ground oats compared with wheat bran (pp. 46–51).—Feeding a constant basal ration, 4 lbs. of wheat bran was compared with 4 lbs. of ground oats in 3 periods of about 3 weeks each.

"These results show a slightly larger yield when oats were fed than when bran was fed, but the differences are not sufficiently large for one to say that oats have a greater feeding value than bran. . . . Their mechanical condition is such that they are equally good to mix with heavier feeds like corn, cotton seed, and gluten meals."

Nutriotone for the production of milk (pp. 51–55).—This material is said to be extensively advertised in the State, and the claim made that it is not only a curative agent but a stimulant to the production of flesh and milk. Five Jersey cows, fresh in milk, were fed liberal rations of hay and grain in proportion to their size; and, in addition, in the first, third, and fifth periods, the prescribed amount of Nutriotone was fed, and in the fourth period 2 spoonfuls of linseed meal in each feed was substituted for it. The results are summarized as follows:

Summary of results with and without Nutriotone.

	Milk.	Butter fat.
	Pounds.	*Pounds.*
Average for 21 days without Nutriotone	2,281	101
Average for 21 days with Nutriotone	2,264	101

"In neither of these cases did Nutriotone seem to have any effect, favorable or unfavorable. The slightly smaller milk flow with Nutriotone does not mean anything in particular except to add increased emphasis to the falseness of the claim that 2 large tablespoonfuls fed with each feed 'will produce a great increase of much richer milk.'"

Remarks are made on the use of condimental food, and a tonic is recommended for use when animals are out of condition and in need of such treatment.

The food requirements and production of different breeds of cows, R. GRIPENBERG (*Tidn. Mjölkhushall., 6 (1897) Nos. 31–37*).—The paper gives a discussion of the comparative economy and productive capacity of Holstein, Ayrshire, Angler, and Finnish breeds of cows and of crosses, kept at the Mustiala Agricultural and Dairy Institute, from 1885–'96. Tables giving the amounts of hay and concentrated food consumed and milk produced during each year for the various breeds are included in the paper. The quality of the milk produced was unfortunately only ascertained during 4 years, 1889–'91 and 1896. The members of "food units" given in the table refer to hay and concentrated food consumed, the value of the former being considered one-half that of the latter. Pasturage was the same for all cows, and the quantities of straw and roots (or silage) eaten were considered compensated for by the manure produced by the cows.

Production and relative economy of different breeds of cows.

Breed.	Average number of cows, 1889–'96.	Per cow per year, 1885–'96.					Food units required per—	
		Hay.	Concentrated food.	Food units.	Milk produced.	Fat content (4 years).	100 kg. milk.	1 kg. cream (3 years).
		Kg.	*Kg.*		*Kg.*	*Per cent.*		
Holstein	10	1,625	519	1,331	3,159	3.0	42.2	9.6
Ayrshire	24	1,483	416	1,157	2,376	3.6	49.0	8.6
Angler	7	1,449	407	1,132	2,330	....	48.7	10.1
Crosses	11	1,539	475	1,244	2,789	3.4	45.0	....
Finnish native	13	1,373	379	1,070	1,892	3.6	56.1	9.8

Valuing a food unit at 2 cts., milk at 2 cts. per kilogram, butter at 43 cts. per kilogram, and skim milk at 0.6 ct. per kilogram, the author arrives at the following figures, which indicate the profit per year and per cow for the different breeds: Holstein $38, Aryshire $33, Angler $26.50, crosses $38, and Finnish native $23.—F. W. WOLL.

Feeding trials with silage and potatoes, J. L. HILLS (*Vermont Sta. Rpt. 1896–'97, pp. 169–174, 218–220*).—A comparison was made with 2 cows of corn silage and a silage made from a mixture of cowpea vines and soy beans. At the time of ensiling the mixed silage contained about 23 per cent of crude protein in dry matter, while the corn silage contained about 11 per cent.

"The mixed silage lost very heavily of its protein in the silo, however, and came out hardly richer in that ingredient than was its competitor. The reasons for this loss are not clear. The corn silage in another portion of the same silo kept nicely. . . .

"Less but better milk and essentially equal yields of solids and fat were made from somewhat more total dry matter on the soy bean-cowpea silage than when corn silage was fed. One hundred pounds of dry matter in corn silage proved superior to the same amount in the mixed silage. The mixed silage analyzed but little better than the corn silage, cost more to grow and harvest, yielded less, and was distasteful to some cows. The marked increase in the quality of the milk following the feeding of the mixed silage, while suggestive, is not thought to be due as much to change of feed as to a coincident shrinkage in the milk flow."

Corn silage and potatoes were compared in an experiment with 6 cows, covering three 4-week periods.

"The cows ate more freely of the potatoes than of the silage and while on the potato ration consumed more dry matter, yet in 5 out of 6 cases they made no more milk and in one case but little more. The milk did not change in quality and essentially equal quantities of total solids and fat were produced on each ration. Since increased production did not follow the more hearty eating, a pound of dry matter in the form of potatoes was less effective than a similar amount of dry matter in the form of silage. Potatoes at 15 cts. a bushel are more costly as stock food than silage."

Record of the station herd for 1895–'96, J. L. HILLS (*Vermont Sta. Rpt. 1896–'97, pp. 181–188*).—The record is given for 37 cows from November 1, 1895, to October 31, 1896:

"As a herd the average cost of food for 100 lbs. of herd milk was 77.3 cts. and for a pound of butter, 13 cts. . . . Twenty-eight of the individual cows whose records appear in the preceding table, together with 2 others, formed the herd of which the record was published in our last report. Comparing the records of the 2 years we find that 12 cows gave more, 2 the same, and 14 less milk the second year than they did the first; that 12 gave more, 2 the same, and 14 less butter in 1895–'96 than in 1894–'95; while 11 gave better, 10 poorer, and 7 the same quality of milk in the latter as compared with the former year. The average for the 28 cows shows almost exactly the same production each year, but at greatly reduced cost during the latter year."

Average record of twenty-eight cows for two years.

Year.	Yield of milk.	Fat content of milk.	Yield of butter.	Cost of food.	Cost of purchased grain.	Cost of food per lb. butter.	Proceeds of butter sales.
	Pounds.	*Per cent.*	*Pounds.*			*Cents.*	
1894–'95	5,616	5.02	329	$50.36	$18.92	16.2	$77.18
1895–'96	5,586	5.03	328	43.72	14.49	14.1	75.48

"It is again shown that the Ayrshire cow is more successful as a milk maker than as a butter producer. As a general rule the cows making the most butter were the most economical producers. The larger cows, which ranked well in gross amounts of butter made, graded lower in most cases in economy of production, while the smaller cows, which stood near the head in amount of butter made, did not lose rank in the matter of cheap manufacture. In other words, the well-known fact that the smaller cow usually makes the cheapest butter is again demonstrated."

The effect of food upon the quality of butter, J. L. HILLS (*Vermont Sta. Rpt. 1896–'97, pp. 175–181*).—In connection with some of the experiments described above, studies were made of the effect of the rations upon the quality of the butter and upon churnability. The scoring and the chemical analysis of the butter are given and the data for churning. The results are briefly summarized as follows:

"*Effects upon butter.*—Butter made from a ration containing large amounts of potatoes was of poor quality, tended to be salvy and did not keep well. It showed, upon chemical analysis, a medium amount of volatile acids, but a very low iodin number.

"Butters made from 3 hay and silage rations, containing respectively large amounts of corn and bran, of Atlas gluten meal, and of cotton-seed and linseed meals, were scored by experts essentially alike. The butter made upon the rations containing relatively large amounts of Atlas gluten meal was judged by the station dairyman to be on the whole a shade inferior to the others, particularly in grain. The only marked difference developed on chemical analysis concerned the iodin number, which in the Atlas butter was uniformly high, indicating probably an increased percentage of olein.

"*Effects upon churning.*—The creams from the milks made on the Atlas ration invariably churned less exhaustively than those made upon either the corn and bran or the cotton-seed-linseed rations, all other conditions being equalized. No plausible reason other than that of food effect presents itself, yet the writer feels unwilling as yet to assert that the Atlas ration was at fault in the matter."

Report of the dairy investigator, F. B. LINFIELD (*Utah Sta. Rpt. 1897, pp. 51–60*).—Remarks on the work of the division, an experiment with pasturage for cows, variations in the fat content of milk, and the value of by-products of the dairy for feeding pigs (see p. 871). Trials for 2 summers with 2 cows showed the advantages of properly seeded pastures for dairy cows as compared with the ordinary range. "It would take a yield of from 48 to 62 bu. of wheat per acre, at average prices for the past 3 years, to return as much as could be made by pasturing cows." The variations in the fat content of the first milk and strippings, the morning's and night's milk, and that from day to day, and in the herd milk, with advancing lactation, are illustrated. The failure to recognize these normal variations is believed to be a frequent cause of dissatisfaction with the method of paying for milk by test.

Preliminary investigations concerning the number and nature of bacteria in freshly drawn milk, V. A. MOORE (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 261–266*).—Bacteriological examinations were made of the milk of 9 cows. The teats and udders of the cows and the hands and arms of the milkers were washed with a dilute solution of corrosive sublimate, and the milk was drawn directly into sterilized bottles.

"In collecting the milk, from 5 to 10 cc. of the fore milk was taken in separate bottles from each quarter of the udder and about 50 cc. near the close of the milking, except in 5 cases. The milk was taken directly to the laboratory and agar plates (in a few instances gelatin plates also) were made with definite quantities (from 0.1 to 1 cc.) of the milk."

The number of colonies found in each case are tabulated. This shows that "in every case bacteria were found in the last milk taken from one or more quarters of the udder."

"These results, as well as those heretofore reported, show an almost constant appearance of bacteria, often in small numbers to be sure, in the milk taken during the last part of the milking. . . .

"The properties of the bacteria found in the fore milk are of more importance than their numbers. . . . A thorough differential study of the bacteria which I have found in freshly drawn milk has not been completed. In all, 20 apparently different species were isolated. Of these, 3 were streptococci, 4 bacilli, and 13 micrococci. Among the bacilli *Bacillus cloacæ* occurred in one specimen. It is possible, as it occurred but once, that it was an accidental contamination from external sources. This was the only gas producer in the entire series. Nine of the apparent species were aerobic, indicating their presence near the end of the teat or milk duct, and the others were facultative anaerobic, and could have come from much higher up in the teat.

"With one exception the organisms isolated fermented lactose in both bouillon, to which chemically pure lactose had been added, and in milk itself, giving a decidedly acid reaction. . . . Six of the 20 species produced a firm coagulation of the milk within 20 hours. The others precipitated or coagulated the casein in from 4 to 10 days. . . .

"The pathogenesis of these organisms was tested by the subcutaneous inoculation of 0.5 cc. of a fresh bouillon culture into guinea pigs, but invariably the animals remained well. In fact, a perceptible local lesion was not produced in any case. . . .

"[In view of the fact that the number of lactic acid bacteria in fresh milk appeared to increase rapidly] it seems very important that milk should be pasteurized, if its normal composition is to be retained, as soon as possible after being drawn. Milk that has stood under ordinary conditions for from 4 to 12 hours before its bacterial flora is destroyed must necessarily have undergone more or less deleterious changes, the extent of these alterations depending upon the temperature at which it is kept and the number and nature of the bacteria in the fore milk. It is well known that all milk pasteurized after it is delivered by the milk vender does not agree with all children."

The double-necked Babcock bottle for testing skim milk and buttermilk, M. E. McDonnell (*Pennsylvania Sta. Rpt. 1896, pp. 221–224*).—A series of 10 tests was made on 12 samples of skim milk of different fat content, using the double-necked test bottle described by Farrington.[1] The method was found satisfactorily uniform for the same sample. All the results were believed to be slightly low on account of a small quantity of the fat remaining in suspension and a minute quantity probably being dissolved by the acid. Skim milk

[1] Wisconsin Sta. Bul. 52 (E. S. R., 8, p. 932).

found by analysis to contain 0.16 per cent of fat was diluted with known quantities of water and with milk and the fat determined by test and by analysis. "The double-necked Babcock bottles gave results 0.01 per cent lower than the calculated amount, and 0.08 per cent lower than those actually obtained by gravimetric analysis."

In conclusion the results obtained with a double-necked bottle by Farrington are quoted.

Creameries or butter factories; advantages, location, organization, and equipment, H. E. ALVORD (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 297–316, pls. 7, figs. 4*).—After brief introductory remarks the author treats of the extent of the creamery system in different States, the advantages of creameries, location, methods of operation, and the construction and equipment of creameries, giving illustrations and plans of creameries, and accounts of the operations of a number of creameries. The appendix contains blank articles of agreement for creameries, by-laws of creamery associations, and a statement of the principal apparatus needed to equip a butter factory for 500 cows or less.

Composition of full-cream cheese, W. FREAR (*Pennsylvania Sta. Bul. Inf. 2, pp. 16*).—This is a compilation of work at the stations in New York, Wisconsin, Iowa, and Minnesota, and at the Ontario Agricultural College, together with a statement of the requirements of the Pennsylvania cheese law, passed June 23, 1897. This law divides cheese into 5 grades according to its fat content as follows: Full cream, with not less than 32 per cent of fat; three-fourths cream, with not less than 24 per cent of fat; one-half cream, with not less than 16 per cent; one-fourth cream, with not less than 8 per cent; and skimmed cheese, including all cheese with less than 8 per cent of fat.

"(1) Experiments on a large scale in 5 States and Provinces show that average factory milk very rarely produces green cheese containing less fat than the Pennsylvania legal standard for full-cream cheese, viz, 32 per cent.

"(2) Four sets of experiments show that the green cheese loses about 5 per cent in weight during 1 month's curing, and that this loss is chiefly in the water content of the cheese. Consequently, a green cheese containing only 30.5 per cent of fat will probably be of standard "full cream" quality after 1 month's curing.

"(3) Neither minor variations in manufacture—providing gross carelessness be avoided—nor variations in the factory milk supply, unless it include much partly skimmed milk, are to be feared as a cause of deficiency in fat."

Care of milk on the farm, R. A. PEARSON (*U. S. Dept. Agr., Farmers' Bul. 63, pp. 38, figs. 9*).—This bulletin calls attention to bacteria as the cause of milk fermentations, the conditions affecting bacterial growth, the number and kinds of dairy bacteria, and the ways in which milk becomes impure—(1) diseased animals and persons and unnatural conditions, (2) uncleanliness in the stable, and (3) uncleanliness outside the stable; and discusses the means of keeping milk pure by maintaining healthy cows, cleanliness in the care and handling of the animals and in the employees; the construction of dairy houses; and milking, aerating, and cooling milk and storing it. In conclusion 50 dairy rules are given which are based on the text of the bulletin.

Dairying in Oregon, H. T. FRENCH, G. W. SHAW, and F. L. KENT (*Oregon Sta. Circ. 1, pp. 32, pls. 2, figs. 5*).—This is a popular article treating of grasses and forage plants, principles of cattle feeding, chemistry of milk, milk testing, practical butter making, etc.

Fodder crops for cattle on a 40-acre lot, W. SAUNDERS (*Canada Expt. Farms Rpts. 1896, pp. 75–80*).—During the first year of the experiment 14 cows were kept on the produce of a 40-acre lot, during the second year 23, the fourth year 25, and the fifth year 24. The bedding used was not obtained from the lot. During the third year the experiment was interrupted.

Sunflower-seed cake for milch cows, HERTER (*Molk. Ztg., 11 (1897), No. 52, pp. 848, 849*).—A trial of feeding sunflower-seed cake to a herd of cows in connection with roots and wheat bran, resulted in the production of a very soft butter, which was troublesome even in winter.

On the effect of various grain foods on the milk production of cows (*Milch Ztg., 26 (1897), Nos. 43, pp. 679–682; 44, pp. 697–700; 45, pp. 713–716*).—A short account of work by Ramm reported from another source (see p. 879).

Contribution to the rational feeding of cows (*Milch Ztg., 26 (1897), No. 51, p. 813*).—A brief account of investigations by Hagemann already abstracted from another source (E. S. R., 7, p. 237; 8, p. 788).

The practical and industrial control of milk, P. DORNIC (*Le control pratique et industriale du lait. Mamiolle, 1897; rev. in Jour. Hyg., 22 (1897), No. 1097, p. 466*).—Among other matters the author discusses the different apparatus used and methods employed in detecting fraud in handling milk.

The water content of butter, A. HALENKE (*Forsch. Ber. Lebensmtl., 4 (1897), No. 12, pp. 347–350*).

Matzoon, B. MARTINY (*Milch Ztg., 27 (1898), No. 1, p. 6*).—It is noted that in Armenia, where kephir does not occur, the organisms used in preparing matzoon from milk are also used for ripening cream.

Milk somatose, A. BRESTOWSKI (*Pharm. Ztg., 42 (1897), p. 845; abs. in Chem. Ztg., 21 (1897), No. 103, Repert., p. 325*).—This is a food preparation similar to somatose made from meat but made from milk and containing 5 per cent of tannin. It is a fine yellowish powder, very soluble in water. The method of preparation is not given.

Unorganized ferments of milk—a new factor in the ripening of cheese, S. M. BABCOCK and H. L. RUSSELL (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), p. 617; abs. in Chem. Ztg., 22 (1898), No. 3, Repert., p. 14*).

The microscopic examination of butter for bacteria, especially Bacillus tuberculosis, O. ROTH (*Korbl. Schweizer Aerzte, 1897, No. 18, p. 545; abs. in Hyg. Rundschau, 7 (1897), No. 24, pp. 1263, 1264*).

Preservation of cream for market, F. L. RUSSELL (*Maine Sta. Rpt. 1896, pp. 141–145*).—A reprint of Bulletin 23 of the station (E. S. R., 7, p. 992).

The "latent" coloring of margarin, H. SCHROTT (*Milch Ztg., 26 (1897), No. 47, p. 746*).—A condensed account of a pamphlet recently published by the author. The proposed plan is discussed by requiring the addition of sesame oil to margarin, since this oil can be easily detected by the color it gives in the test, and so furnishes a means of recognizing margarin. It is believed, however, that coloring with phenolphthalein furnishes greater protection to consumers.

The examination of margarin and butter for sesame-oil content, P. SOLTSIEN (*Pharm. Ztg., 42 (1897), p. 837; abs. in Chem. Ztg., 21 (1897), No. 103, Repert., p. 325*).

Inspection of glassware used by creameries and butter factories to determine the value of cream and milk, J. M. BARTLETT (*Maine Sta. Rpt. 1896, pp. 150–153*).—A reprint of Bulletin 26 of the station (E. S. R., 8, p. 172).

A modification of the Babcock method and apparatus for testing milk and cream, J. M. BARTLETT (*Maine Sta. Rpt. 1896, pp. 165–172, figs. 2*).—A reprint of Bulletin 31 of the station (E. S. R., 9, p. 184).

An improved milk scale, H. D. RICHMOND (*Analyst, 23 (1898), Jan., p. 2*).—This improvement permits the operator to determine the density of the milk without previous reduction to the normal temperature.

A calculation of the total solids of milk, M. E. McDonnell (*Pennsylvania Sta. Rpt. 1896, pp. 82–84*).—The method of calculating the total solids of milk by means of the Hehner and Richmond formula is described and a table is given showing the percentage of total solids in milk corresponding to the Quevenne lactometer reading and percentage of fat.

Graduation of the Leffmann-Beam bottles, G. E. Scott-Smith and A. B. Searle (*Analyst, 23 (1898), Jan., p. 3*).—The use of alcohol instead of mercury or water is recommended in calibrating the bottles.—L. H. MERRILL.

Test of separators, J. M. Bartlett (*Maine Sta. Rpt. 1896, pp. 35, 36*).—Four tests are reported with United States Separator No. 5, 4 with DeLaval Baby No. 2, and 3 with Empire No. 5. "The operator could detect no material difference in the ease of running of the United States No. 5 or Baby No. 2. The Empire being a larger machine, of course ran harder. He, however, preferred the United States to the others on account of the simplicity of the bowl, it requiring less time to set it up clean, etc."

A test of hand separators, H. Hayward (*Pennsylvania Sta. Rpt. 1896, pp. 57–78*).—A reprint of Bulletin 38 of the station (E. S. R., 9, p. 386).

Tests of dairy apparatus, J. L. Hills (*Vermont Sta. Rpt. 1896–'97, pp. 191, 192*).—Results are given of tests of the following separators: DeLaval Alpha, Baby No. 2 and No. 3; DeLaval Alpha, Dairy Turbine No. 3, DeLaval Alpha, Humming Bird, Empire No. 5 and No. 7 (Mikado); Sharpless Safety, Hand, United States No. 3 and 5, and United States No. 7 (Midget).

Gouda cheese, H. Hayward (*Pennsylvania Sta. Rpt. 1896, pp. 79–81*).—The method of making Gouda cheese is described and references made to some preliminary trials conducted at the station. "In these preliminary trials 100 lbs. of milk, testing about 5 per cent fat, yielded 14 lbs. of green cheese. The amount this will cure out will depend somewhat on circumstances. Some experiments state that in 2 months the cheese would lose about 17.5 per cent of its weight."

The constitution of milk with special reference to cheese production, S. M. Babcock (*Wisconsin Sta. Bul. 61, pp. 21, figs. 3*).—This is a popular bulletin on the yield, physical constitution and composition of milk, the fat globules and other constituents of milk, conditions affecting the composition, relative value of milk, relation of milk constituents to cheese, and the calculation of the yield of cheese. Under the latter head a table is given showing the yield of cheese from 100 lbs. of milk corresponding to different fat contents from 2 to 6 per cent and different lactometer readings.

The author mentions the finding of soluble ferments in milk as normal constituents by H. L. Russell and himself (E. S. R., 9, p. 205).

VETERINARY SCIENCE AND PRACTICE.

Investigations of diseases of domestic animals, T. Smith (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 119–183, pls. 5*).—*Notes on sporadic pneumonia in cattle: Its causes and differentiation from contagious pleuropneumonia* (pp. 119–148, pls. 4).—The causes and characteristics of sporadic pneumonia and epizootics of infectious pneumonia are discussed and a description given of the bacteria associated with the disease, and some points of difference between sporadic broncho pneumonia and contagious pleuropneumonia. In conclusion it is stated that sporadic pneumonia in cattle generally occurs as broncho-pneumonia, which may be complicated by emphysema and by interlobular trouble which simulates contagious pleuropneumonia. Broncho-pneumonia as a cattle disease is comparatively rare, and is probably due to the entrance of fluids into the air tubes during drenching.

When secondary to tuberculosis, foreign bodies, etc., these cases are easily recognized.

Nothing definite is known relative to traumatic or transit pneumonia due to blows on the thorax. The interlobular disease and the persistence and existence of lung disease are apparently to be attributed to bacteria of the swine plague group present in broncho-pneumonia in pure cultures found in healthy cattle in the upper air passages. Most of the cultures made from the parenchyma, interlobular fluids, and exudates in interlobular pneumonia remain sterile. Other differences than the bacteria of bovine pneumonia being more frequently provided with a capsule than those found in swine are not constant. Outbreaks of infectious pneumonia and septicæmia in calves are thought mostly due to highly virulent rays of the same group of bacteria.

Two varieties of the tubercle bacillus from mammals (pp. 149–161).—An account is given of an investigation of a bacillus from an animal of the bear tribe (*Nasua narica*) and from a bull. The morphological and other characteristics seem to indicate differences in the germ which the author seems inclined to believe to be valid. He points out the necessity for more information on the existence of races of tubercle bacilli (both human and bovine).

Notes on the evolution of hog cholera outbreaks (pp. 161–166).—The conclusions arrived at are that swine themselves are the chief carriers of the infection. The custom of not immediately removing dead hogs from the neighborhood of the living is deprecated; that the disease may be perpetuated and spread by preventive inoculation with living cultures; that the waves of epizootics which sweep over the country at long intervals are probably to be attributed to a sudden increase in virulence of the specific bacilli after they have passed through the bodies of swine for several years; that pathogenic bacteria are always a menace.

Swine erysipelas or mouse septicæmia bacilli from an outbreak of swine disease (pp. 166–174).—A somewhat detailed account is given of the morphological, biological, and pathogenic action of this bacillus which was not definitely proved to be pathogenic toward swine. Attention is called to the importance of rational feeding as a preventive in regions infected with certain diseased germs.

Notes on peculiar parasitic infections of the liver in domesticated animals (pp. 174–179).—The frequent existence of minute focal lesions in the liver of some domestic animals which may in all cases be due to ova of parasites or disintegrated particles of the same brought in from the digestive tract is shown to complicate the diagnosis of disease, since such lesions may sometimes be attributed to tuberculosis, glanders, or other serious affections.

Two cases of cirrhosis of the liver (pp. 179–183, pl. 1).—A semipopular description of a case of cirrhosis of the liver in a steer and of one in the liver of a horse.

Infectious leukæmia in fowls—a bacterial disease frequently mistaken for fowl cholera, V. A. MOORE (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 185–205, pls. 6*).—A description is given of several cases of leukæmia and of the specific microorganism, *Bacterium sanguinarium* n. sp., that causes it. The cultural characteristics, pathogenesis, constancy of virulence, symptomatology, morbid anatomy, etiology, and differential diagnosis, prevention, and treatment are discussed. The disease differs from fowl cholera in the intestines being pale, intestinal contents normal, lungs normal, and in the specific organisms being comparatively few in the blood. The specific organism differs from the bacterium of fowl cholera by usually appearing in pairs united end to end or in clumps, by rarely staining at the poles and saponifying milk, by its resistance to drying from 8 to 12 days, by killing rabbits inoculated subcutaneously in from 6 to 10 days instead of from 18 to 24 hours, and in not killing fowls when injected subcutaneously in small quantities. The best remedy noted is cleanliness. A mixture of equal parts of carbolic acid and sulphuric acid, among other things, is recommended as a disinfectant.

In conclusion it is stated that some cases popularly called fowl cholera are not fowl cholera, but a disease resembling it in certain symptoms and in its fatality, and differing from it in its morbid anatomy and specific organism. This specific organism in its physiological properties resembles somewhat closely *Bacillus typhosis*. The disease seems to be more prevalent than fowl cholera and old fowls seem more susceptible to it than chicks.

Leeches, P. A. FISH (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 229–259, pls. 7*).—This is an historical investigation of two cases of equine mycosis, with an historical account of a supposed similar disease called bursattee, occurring in India. The geographical distribution, histology, pathology, and anatomy are discussed.

Under the head of "Some other diseases of mycotic origin" are described actinomycosis, Madura disease (mycetoma), pathogenic blastomycetes, and œdema mycosis (South African horse sickness). In his general summary of the paper the author notes that he reports for the first time the presence of a fungus in "leech" tissue. The fungus is found in the inflammatory growth and may, though rarely, be seen ramifying into adjacent tissue. The fungus appears in various forms, evacuolated and shrunken, branching irregularly, and sometimes with a transparent gelatinous sheath around the mycelial axis. Two kinds of wandering cells were observed—one containing numerous spore-like bodies, the other large numbers of vacuoles. The latter kind were the most numerous. Bacilli staphylococci and streptococci were found, but the author thinks they have no etiological relation to the disease.

Although they were not found, spores are thought to exist. The fungus or its spores, it is thought, enter the body either through the mouth or through some abrasion of the skin, or both. The disease affects the subcutaneous tissue in the less vascular parts of the body. Assuming that bursattee and leeches are similar, the disease attacks both mules and cattle instead of mules alone, as in India. The American form of the disease is the more virulent. Compared with actinomycosis, leeches exhibits a preference for the equine family where the former prefers cattle. Finally the author assumes that the fungus may exist on plants, in the air, and in water. He was not able to learn of any cases of human infection.

An outbreak of a nonspecific disease among swine, V. A. MOORE (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 219–227*).—Following a few general remarks it is noted that the existence among swine of large numbers of destructive enzootic diseases that are not contagious, and therefore are limited in their spread, is very probable. Outbreaks of such diseases appear to be more frequent in the West, where large herds of swine follow corn-fed cattle and where little or no attention is given to food or shelter. A somewhat detailed description is given of an outbreak of a swine disease at Brookeville, Maryland. A bacteriological examination revealed the presence of *Bacillus coli-communis* and others of the same group. The author seems inclined to attribute the death of the animals to these organisms.

Effects of tuberculin on tuberculous cows, F. L. RUSSELL (*Maine Sta. Rpt. 1896, pp. 56–63*).—A record is given of experiments with tuberculin on tuberculous animals. Out of 116 tests made 33 reactions were obtained, leaving 83 failures. Why such results should be obtained does not appear. The amount of tuberculin used in making the injection was always uniform for the same stage of maturity. Animals so slightly diseased as not to be detected by a physical examination gave such widely different results that the author is forced to the conclusion that it is a matter of uncertainty whether a slightly diseased animal will react or not. A reaction may be obtained at one time and again a month later; or, a reaction may fail for as many as 3 years and then a very decided reaction may be obtained. That there is some law underlying the phenomena seems plain to the author, although he is not able to state what it is. Some animals, it is found, react repeatedly, while others do not, and the intervals between reactions vary from 2 days to more than a year. The author finds no grounds for supporting the theory that failure of tuberculous animals to react is due to an acquired tolerance of tuberculin. It is suggested "that the failure of tuberculin to cause reaction in tuberculous cows at times may be due to the fact that the disease is not making steady progress."

Tuberculosis in the herd of dairy cattle at Aas Agricultural College, Norway, H. ISAACHSEN (*Ber. Höjere Landbrugsskole Aas, 1895–'96, pp. 84–86*).—Tuberculin tests made in June, 1895, showed that 113 head of cattle reacted out of 145 head in the herd (calves included), or 78 per cent; 3 cases were suspicious; 85 per cent of 104 cows, two-year old or over, reacted; 75 per cent of 16 one to two year old heifers, and 52 per cent out of 25 calves less than a year old. The Ayrshire cows in the herd contained a larger proportion of diseased animals than the pure-bred domestic breeds, Telemark and Gudbrandsdal, or the crosses.—F. W. WOLL.

A plant that poisons cattle, U. P. HEDRICK (*Oregon Sta. Bul. 46, pp. 12, pls. 4*).—*Cicuta vagans*, which grows in the low pasture lands of Oregon, has been found to poison cattle in late winter and early spring. According to the author not less than 100 cattle in various parts of the State were poisoned last spring by this plant.

In an experiment in which the bulb was cut into small pieces and fed, along with carrots cut in the same way, to a 2-year-old heifer at 8 o'clock a. m., death resulted 1½ hours later. Upon post-mortem examination, pieces of the root were found in the rumen and in the second stomach. The lungs were highly congested, but otherwise nothing abnormal was noted. On the following day an experiment with a calf was made at 9.15 a. m., and an attempt made to counteract the effects of the poison by giving an ounce of turpentine in a quart of milk. The calf recovered its feet and tried to walk. Soon there were indications of spasms, and the dose of turpentine and milk was repeated, when the calf stood up until 11.30 a. m., then it went down as before. Aconite and milk were then given, and also a hypodermic injection of nitroglycerine, but the animal died at 11.45 a. m. From the beginning of the experiment there was a decided rise in temperature, the highest being to 106¼° F. Similar experiments were made later in the season (May), and it was learned that a much larger amount of the bulbs could then be consumed without serious effects. Hence the author concludes that cattle are likely to be poisoned only from the first of January to the middle of May. The simple remedies, such as old bacon grease, flour, and milk, recommended by stockmen in milder cases, the author thinks may be of some value, but that they will be unavailing with an animal that has swallowed even a very small quantity of the bulb when the poison is virulent. The best remedies are eradicating the plant from pastures or keeping cattle from lands where it grows.

Report of the veterinarian, A. T. PETERS (*Nebraska State Bd. Agr. Rpt. 1896, pp. 191–216, pls. 7*).—With the exception of a few tables, this is a reprint of Bulletin 47 of the Nebraska Station (E. S. R., 9, p. 93). A compiled popular account of glanders in its various forms is added.

Contagious diseases of animals in Great Britain, D. E. SALMON (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 37–75*).—This is a concise and critical account of the history of the struggles in Great Britain against swine fever, pleuropneumonia, tuberculosis, foot and mouth disease, and anthrax. The great disadvantage of leaving the diseases to independent local control, as was done in earlier times, is thoroughly brought out and compared with the advantages of control of repressive measures by a single central authority. The figures given by the author show a general decrease in the number of animals affected with the various diseases with the exception of swine fever. In the case of pleuropneumonia, for example, there were between 1870 and 1879 on an average 5,995 animals attacked per annum, while during the succeeding decade the average per annum was only 2,017, and from 1890 to 1894, inclusive, there was an average of only 602 animals attacked.

A report on rabies in Washington, D. C., V. A. MOORE and P. A. FISH (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 267–283, pls. 3*).—The method of inoculation for the diagnosis of rabies is described, a detailed account given of the cases received, and the pathology and etiology of the disease discussed. The difficulty if not impossibility of making a diagnosis of rabies in the street dog without the aid of inoculation is noted, as well as the fact that many dogs are supposed to be mad when they are not, and conversely, that many dogs not supposed to be mad die of rabies.

Texas fever in Australia, D. E. SALMON (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 85–95*).—An account is given of Texas fever in Australia, mostly compiled from the reports of C. J. Pound, director of the Queensland Stock Institute, of Brisbane. Among other things it is noted that Director Pound has found a protozoan parasite in the young cattle tick (*Ixodes bovis*), which, although smaller, is believed to be identical with the parasite causing the fever, although no such parasite was found in the adult tick.

Texas fever in Kansas (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 318–321*).—The source traced to southern California.

The detection of tuberculosis in cattle, C. CURTICE (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 283–295, pls. 3*).—The various pieces of apparatus needed and the methods of using them are described, and the proper method of disposing of tuberculous cattle briefly set forth.

The suppression and prevention of tuberculosis of cattle and its relation to human consumption, J. NELSON (*Agr. Gaz. New South Wales, 8 (1897), No. 6, pp. 370–383*).

Results of curative experiments on cattle affected with tuberculosis, W. SAUNDERS (*Canada Expt. Farms Rpts. 1896, pp. 89–93*).—A record is given of the temperature results from injection of tuberculin, and also the details of some postmortem examinations.

Tuberculosis in swine, the nature of the disease, with a report of three cases, V. A. MOORE (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 207–218, pls. 4*).—The occurrence of the disease in Europe is briefly noted; the source of infection, symptoms, diagnosis, morbid anatomy and the relation of swine tuberculosis to public health are discussed; and the 3 cases described.

The communication of hog cholera by carrion crows, T. S. FORD (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 325, 326*).—An account is given of an outbreak of this disease attributed to germs carried on the feet of carrion crows.

An outbreak of cattle disease in Kansas (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 322–325*).—Notes on a supposed outbreak of contagious pleuropneumonia—a false alarm.

Ergotism in Kansas (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 317, 318*).—An account of an outbreak at Selma, Kansas.

An epidemic of purulent inflammation of the milk ducts, affecting seventy cows, W. R. STOKES and A. W. CLEMENT (*Jour. Comp. Med., 1897, No. 3, pp. 135–138; abs. in Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No. 22–23, p. 895*).

How is calf fever to be prevented? (*Landw. Wchnbl. Schleswig-Holstein, 47 (1897), No. 37, p. 525*).

Protective inoculation against swine erysipelas (*Sächs. Landw. Ztschr., 45 (1897), No. 26, p. 310*).

Protective vaccination against swine erysipelas, LORENZ (*Braunschw. Landw. Ztg., 65 (1897), No. 36, p. 159*).

The bacillus of the foot and mouth disease (*Deut. Med. Wchnschr., 23 (1897), No. 8; abs. in Ztschr. Wiss. Mikros. u. Mikros. Technik., 14 (1897), No. 1, pp. 117, 118*.—A small bacillus always found measuring 0.5 to 0.9 μ long by from 0.3 to 0.4 μ thick. In hanging cultures somewhat motile. Stains well in watery anilins, best in carbolfuchsin. Typical form appears in 24-hour cultures. Young bouillon cultures in brood oven show somewhat coccus-like forms. The longer forms—0.9 μ—can be obtained on gelatin plates kept at 20°. Coli-like growth on media.

The status of the knowledge of the foot and mouth disease (*Deut. Landw. Presse, 24 (1897), No. 77, p. 708*).

Dipping cattle for the destruction of ticks, D. E. SALMON (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 109–118, pls. 3*).—This is compiled from a report by V. A. Nörgaard and sets forth the various points to be taken into consideration in performing experiments for determining the proper disinfectant and the strengths of the same to be employed in disinfecting cattle.

Aside from glycerin, the best of all remedies as a dip, but which is too expensive for practical purposes, there are 2 coal-tar preparations, chloro-naphtholeum and The Lone Star Cattle and Sheep Wash. The former is readily soluble in soft water and works well in a 2 per cent solution. In a trial test 40 cows, all very ticky, were dipped; 24 hours later the smaller ticks were all dead and also many of the fully gorged ones. On the day following the ticks still living were found to be soft, wrinkled, and of a yellow mottled appearance, and 2 days later were all found to be dead. The same solution was used on 300 head of cattle, many of which were calves less than a year old, and all seemed to endure the dipping without becoming stiff and with only a slight peeling off of the epidermis between the hind legs and on the sides of the neck. Chloro-naphtholeum seems to retain its tick-destroying properties considerably longer than the Lone Star Wash.

The effect of dipping solutions on cattle is described.

Laws of States and Territories for the control of contagious animal diseases (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 333–355*).—Text of the laws of Alabama, Arizona, Kentucky, Massachusetts, Montana, New Jersey, New Mexico, North Dakota, and Pennsylvania.

Transactions of the Bureau of Animal Industry for 1895 and 1896 (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 5–35*).—An account of the transactions of the Bureau for the years 1895 and 1896, with recommendations for legislation.

TECHNOLOGY.

The control of the temperature in wine fermentation, A. P. HAYNE (*California Sta. Bul. 117, pp. 19*).—The factors contributing to rise of temperature in fermenting musts and the means of controlling the temperature are discussed. Wine yeast requires a comparatively low temperature for its normal development and the production of the best wine. A temperature of about 100° F. stops yeast fermentation and at the same time accelerates the growth of various harmful bacteria. The initial temperature of the grapes is higher in California than in many wine-producing regions of Europe; the California musts as a rule have a high sugar and a low acid content, and there is a tendency in California to use very large fermenting tanks. All these peculiarities make necessary some means of cooling the musts.

Descriptions and illustrations are given of a French apparatus for cooling must, of the apparatus used by the station, and also of a modified form of the one used. With the French apparatus the must is pumped through about 500 feet of 1½-in. round tubing, arranged in 2 columns. The tubes are kept cool by the constant dripping of water upon them from a tank above. With the apparatus used by the station the must was forced through a column of tubes having a total length of only 43 ft. Flat tubes 4 by $1\frac{1}{2}$ in. were used. They were kept cool by a fine spray of water carried by a strong blast of air. The evaporation taking place under these conditions added greatly to the cooling effect of the apparatus. It was found that one man could pump from 1,000 to 1,400 gal. per hour and that in passing through the cooling apparatus at that rate the must was cooled from 10 to 13° F.

Preservation of grape juice, J. CRAIG (*Canada Expt. Farms Rpts. 1896, pp. 165–168*).—The process of preparing unfermented grape juice is described and 16 experiments on the preservation of the juice are reported. The results indicate "that the natural flavor of the grape juice may be preserved intact by raising the temperature of the juice gradually to 170° F., keeping it at this point for 10 minutes, and then quickly bottling it, taking care to use absolutely air-tight and thoroughly sterilized vessels. . . . The addition of sugar in the proportion of 4 oz. to each quart of liquid will improve the quality and palatability of the juice of the more acid varieties of grapes. . . . The use of antiseptics such as salicylic acid should not be encouraged."

The canning industry, J. CRAIG (*Canada Expt. Farms Rpts. 1896, pp. 164, 165*).—A note is given on the extent of the canning industry in Canada. The varieties of fruits and vegetables preferred by canners are given in tabular form, being arranged according to their popularity.

The manufacture of potato starch, O. SAARE (*Die Fabrikation der Kartoffelstärke. Berlin: J. Springer, 1897, pp. XII, 577, ill.*).

"Malton wine" and its examination, SCHILLER and TIETZ (*Forsch. Ber. Lebensmtl., 4 (1897), No. 12, pp. 354–361*).

Pure yeasts in wine making, H. BECKER (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 23–24, pp. 667–671*).

On the use of pure yeasts in wine making, J. BEHRENS (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 23–24, pp. 671–674*).

On the acarids of wine of grevache (Carpoglyphus passularum), E. L. TROUESSART (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 6, pp. 363–365*).—On *Carpoglyphus (Acarus) passularum*. The quality of the wine, it is asserted, does not seem to be affected by the presence of the mites. They are readily killed by exposure to light. They attack raisins, and it is through the use of these in wine making that they find entrance to wines.

The examination of certain distilled liquors (Edelbranntwein), K. AMTHOR and J. ZINK (*Forsch. Ber. Lebensmtl., 4 (1897), No. 12, pp. 362–373*).

A study of the rancidity of olive oil, A. LOIR and R. MOULINE (*Bul. Dir. Agr. et Com., 12 (1897), No. 5, pp. 293–296, pl. 1*).

AGRICULTURAL ENGINEERING.

Is electrotechnics adapted to agricultural uses? C. KÖTTGEN (*Landw. Jahrb., 26 (1897) No. 4–5, pp. 637–691, pls. 15, figs. 6*).—The subject is discussed both from the technical and the agricultural side. The conclusion is reached that electrotechnics must make many advances before it is perfectly adapted to agricultural uses. Electricity offers a power easily applied over an extended area and requiring relatively light and easily transportable machinery.

The most favorable conditions for the use of electric power are water power or steam from some other industry for generation of electricity, and complete and uniform utilization of the electricity from a large central plant.

Electric motors are better adapted to plowing than to any other farm operation. They may, however, be applied with advantage to threshing, feed cutting, irrigation, drainage, lighting, etc.

Experiments have shown that the use of electricity for driving farm machines, especially plows, is technically practicable, but its economy is questionable on a farm of less than 600 acres.

Electric plows are about as expensive as steam plows, if the electric plant is used for no other purpose, but they possess the advantage of greater lightness, which better fits them for hilly and soft ground.

An important advantage resulting from the use of motor plows is the improvement of the tilth of the soil and the consequent increase of yield.

Numerous estimates of the cost of producing and applying electricity under different conditions are given.

Irrigation near Greeley, Colorado, D. BOYD (*Water Supply and Irrig. Papers, U. S. Geol. Survey, No. 9, pp. 90, pls. 21, figs. 8*).—In this paper no attempt is made to describe the details of the development of agriculture or of the system of water control in this colony, but simply "to present the more prominent facts and those of most interest and value to the citizens of the West who are now following in similar paths and seeking to lay the foundations for broad and lasting systems of water utilization and control by which the rights of all may be determined and protected." The report is prefaced by an introduction compiled from the records of the Geological Survey and from other sources, to illustrate the climatic and topographic conditions of Cache la Poudre Valley, in which Greeley is situated, and also the limitations of water supply, and discusses the following subjects: Settlement in Cache la Poudre Valley, canal and reservoir systems, conservation of water supply, legislative and judicial control of water, construction and operation of canals, agricultural practice, and underground waters.

Underground waters of southwestern Kansas, E. HAWORTH (*Water Supply and Irrig. Papers, U. S. Geol. Survey, No. 6, pp. 65, pls. 12, figs. 2*).—This is a summary of results of fieldwork carried on during the summer of 1896 with a view to obtaining "detailed information concerning the amount and quality of the underground waters in order to throw light upon the problems connected with the utilization of these in the development of agriculture upon the Great Plains."

"The area discussed in this report is located in southwestern Kansas and covers 1 degree each of latitude and longitude. It is bounded on the east by the one hundredth meridian west of Greenwich, on the west by the one hundred and first meridian, on the south by the thirty-seventh parallel, and on the north by the thirty-eighth. . . . [The author concludes] that the amount of ground water under the area here described is sufficient to meet any demands that will likely be made upon it, even should industries spring up in the West which will use many times as much water as now seems probable. The greatest needs for western Kansas now, and for the whole plains area, are better methods of raising water from beneath the surface, and better methods in using it."

Report of the irrigation engineer, S. FORTIER (*Utah Sta. Rpt. 1897, pp. 38–50*).—This report is devoted mainly to a summary of work on the water supply of the Cache Valley, previously published in detail in Bulletin 50 of the station (E. S. R., 9, p. 427).

New fittings of the cow stable, G. M. GOWELL (*Maine Sta. Rpt. 1896, pp. 22–27, pl. 1, fig. 1*).—The plan and detailed construction of the cow stalls in the station barn are given, with brief notes on lighting and ventilating and a description of a fastening devised for use in bull pens. In the construction of the improved cow stalls the leading features of the "Hoard stalls" were adopted.

STATISTICS—MISCELLANEOUS.

Tenth Annual Report of Georgia Station, 1897 (*Georgia Sta. Rpt. 1897, pp. 130–136*).—An acount of the operations of the station for the year ending December 31, 1897, with notes on the station organization, mailing list, building and repairs, publications, etc.; and the usual statement of receipts and expenditures for the fiscal year ending June 30, 1897.

Reports of director and treasurer of Maine Station, 1896 (*Maine Sta. Rpt. 1896, pp. 1–21*).—Includes a financial statement for the fiscal year ending June 30, 1896, lists of acknowledgments and of available station reports, with brief abstracts of the same; and a report by the director on the personnel of the station and the different lines of work carried on during the year.

Reports of director and treasurer of Pennsylvania Station, 1896 (*Pennsylvania Sta. Rpt. 1896, pp. 3–17, 247–250*).—Treasurer's report for the fiscal year ending June 30, 1896; report of the director reviewing the work carried on at the station during the year; and lists of station exchanges and publications. The financial support given to the station by the State since 1887 is noted and compared with similar data for other States.

Eighth Annual Report of Utah Station, 1897 (*Utah Sta. Rpt. 1897, pp. 66*).—A report by the director on the reorganization of the station staff, the present status of the station, work of the different departments during the year, station improvements, mailing list, publications, etc.; reports by the heads of departments, parts of which are noted elsewhere; and a financial statement for the fiscal year ending June 30, 1897.

Reports of director and treasurer of Vermont Station (*Vermont Sta. Rpt. 1896–'97, pp. 1–27*).—These reports cover the 18 months ending June 30, 1897. An announcement is given as to the purpose of the station and the general scope of the work which it is prepared to undertake. The director's report gives a detailed review of the work of the various departments; notes on the personnel, equipment, mailing list, etc.; and a subject list of the bulletins and reports of the station now in print. Brief summaries of Bulletins 50–59 of the station are appended.

Fifth Annual Report of West Virginia Station, 1892 (*West Virginia Sta. Rpt. 1892, pp. 56*).—A general review of the work of the station for the year, by the director, with more detailed reports by the chemist, agriculturist, entomologist, botanist and microscopist, and treasurer; and a report relative to fruit and nut trees now being tested at Charlestown by W. W. Brown. The report of the chemist is noted in detail elsewhere (see p. 807).

Sixth Annual Report of West Virginia Station, 1893 (*West Virginia Sta. Rpt. 1893, pp. 68*).—A report by the director on the general conduct and operations of the station in its various departments during the year, with recommendations, notes on publications, etc.; and somewhat more detailed reports by the chemist, entomologist, agriculturist, and horticulturist on the work of their respective departments, parts of which appear elsewhere; and a financial statement for the fiscal year ending June 30, 1893.

Seventh Annual Report of West Virginia Station, 1894 (*West Virginia Sta. Rpt. 1894, pp. 44*).—Report of the director on the station organization, improvements, financial status, and the general character and extent of the work in each of the different departments, with various recommendations; more detailed reports by the chemist, horticulturist, and entomologist on the work in their respective departments during the year; and a financial statement for the fiscal year ending June 30, 1894.

Eighth Annual Report of West Virginia Station, 1895 (*West Virginia Sta. Rpt. 1895, pp. 53*).—This includes a detailed report by the director on the organization, personnel, publications, and work of the station during the year, with recommendations as to various improvements in station equipment; reports by the heads of the different departments, some of which are abstracted elsewhere; and a financial statement for the fiscal year ending June 30, 1895.

The cotton crop of 1896–'97, J. HYDE (*U. S. Dept. Agr., Division of Statistics Circ. 8, pp. 14*).—Final report on the cotton crop of 1896–'97, showing in detail the movement of cotton by rail, water, and wagon, and the amounts consumed in mills in each of the cotton-growing States.

Possible influence of importation of Hawaiian sugar on beet-sugar production in the United States (*U. S. Dept. Agr., Office of the Secretary Circ. 7, pp. 4*).—A statement of the production, importation, and consumption of sugar in the United States, with a discussion of the possibilities and limitation of sugar production in Hawaii and the effect of the free importation of Hawaiian sugar upon the sugar-beet industry of the United States. It is maintained that Hawaiian sugar is not likely to compete seriously with the sugar-beet industry in the United States.

Sugar in the Hawaiian Islands, W. HAYWOOD (*Consular Rpts., 1898, No. 209, pp. 238, 239*).—An estimate of the production for 1897–'98 is given, and the yearly production since 1890 is shown in a table. A summary of laborers by nationalities for the years 1890 to 1896 is tabulated.

Sugar production of Europe, H. W. DIEDERICH (*Consular Rpts., 1898, No. 209, p. 237*).—A tabulated report giving the number of factories, the amounts of beets used, and the sugar produced in the different countries during the campaigns 1896–'97 and 1897–'98.

The world's sugar production, H. W. DIEDERICH (*Consular Rpts., 1898, No. 209, pp. 239–242*).—This report gives the beet-sugar production in European countries and the cane-sugar production of all countries for the year 1897–'98. Notes on exportations from Europe and on the beet-sugar industry in European countries are given.

Wheat and flour in Belgium, H. C. MORRIS (*Consular Rpts., 1898, No. 209, pp. 254–261*).—A report on the wheat and flour trade of Belgium.

Live-stock shipments from Canada, Argentina, and Australia to England (*U. S. Dept. Agr., Bureau of Animal Industry Rpts. 1895 and 1896, pp. 77–83*).—Treats of the development and present status of this trade. Live-stock shipments from Argentina to England have proved profitable, and the trade is increasing in volume each year. The estimated shipments from this country to England in 1895 were 39,000 head of cattle and 317,000 sheep. The trade with Australia and New Zealand is still a tentative one, though it is thought probable that the long voyage (between 60 and 75 days), changes in latitude and climate, high freight charges ($40 to $50 per head), and the large amounts of ship room required for feed and water will not make this trade sufficiently profitable to seriously compete with shipment from the United States. Considerable quantities of frozen meats are, however, received from these countries. The trade is yet in initial stages, but it gives promise of being a serious competitor with this country in the meat markets of England. Canada shipped 20,479 cattle to the Deptford cattle market in England during the year ending January 1, 1895, with a loss of but 131 beasts.

Farm ownership and tenancy in the United States, E. ATKINSON and L. G. POWERS (*Amer. Stat. Assoc., 1897, n. ser., No. 40, 329–344*).—An abstract of a paper presented by the authors at the meeting of the International Statistical Institute held at St. Petersburg in August, 1897.

Experiment station work—II (*U. S. Dept. Agr., Farmers' Bul. 65, pp. 32, figs. 7*).—This is the second number of a subseries of brief popular bulletins summarizing the reports of agricultural work in this and other countries. The following subjects are treated: Common crops for forage, stock melons, starch in potatoes, crimson clover, geese for profit, cross pollination, a germ fertilizer, lime as a fertilizer, are ashes economical? and mixing fertilizers.

Experiment station work—III (*U. S. Dept. Agr., Farmers' Bul. 69, pp. 31, figs. 2*).—The third number of the series noted above, the subjects considered being as follows: Flax culture, crimson clover, forcing lettuce, heating greenhouses, corn smut, millet disease of horses, tuberculosis, pasturized cream, kitchen and table wastes, and use of fertilizers.

Marketing farm produce, G. G. HILL (*U. S. Dept. Agr., Farmers' Bul. 62, pp. 28, figs. 7*).—A popular discussion of the general principles involved, with directions for packing, shipping, and marketing the various products of the farm, orchard, garden, apiary, etc.

Number, status, and compensation of employees in the Department of Agriculture (*U. S. Dept. Agr., Office of Secretary Circ. 6, pp. 4*).

Inspection laws in force in Maine (*Maine Sta. Rpt. 1896, pp. 173–183*).—The text of the laws to regulate the sale and analysis of commercial fertilizers, the testing of glassware used at creameries, and to regulate the sale and analysis of commercial concentrated feeding stuffs is given in full. The law regulating the sale of agricultural seeds is not an inspection law, but as it is an important law and some of its provisions are intrusted to the station director, it is also printed in full.

Traveling agricultural schools (*Jahrb. Landw. Gesell., 12 (1897), pp. 24–39*).—The organization and work of these schools in Germany is described. It may be designated as a university extension movement along agricultural lines.

Annual Report of the Live Stock Breeders' Associations, 1896–'97 (*Ontario Dept. Agr. Rpt. 1896, pp. 1–196*).—This contains the usual information.

NOTES.

Arizona Station.—A. J. McClatchie, M. A., has been appointed agriculturist and horticulturist of the station, and located at Phœnix, Arizona.

Colorado Station.—Harvey H. Griffin, B. S., has been appointed to succeed W. Frank Crowley as superintendent of the Arkansas Valley Substation, at Rockyford, Colorado.

Idaho Station.—W. L. Payne, of Moscow, has been elected treasurer of the station to succeed P. A. Reagan, resigned.

Montana College and Station.—Frank Beach, professor of irrigation engineering and agriculture in the college and agriculturist of the station, has resigned, to take effect April 1, 1898.

Nebraska University and Station.—F. W. Card, professor of horticulture in the university and horticulturist of the station, has resigned, to take effect September 1, 1898, and has accepted a similar position in the Rhode Island Agricultural College and Experiment Station.

Oklahoma Station.—There has been a marked increase during the past few months in the applications for the bulletins of this station and in the correspondence requesting information on specific points. The station has completed one stage of an experiment contrasting the value of Kafir corn meal and Indian corn meal as food for steers. In this trial the steers on Kafir corn meal ate more and made better gains than those of like quality fed Indian corn meal.

EXPERIMENT STATION RECORD.

VOL. IX. NO. 10.

The act of Congress making appropriation for this Department for the fiscal year ending June 30, 1899, carries the following general items: Office of the Secretary, $84,300; Weather Bureau, $937,502; Bureau of Animal Industry, $983,440, with $37,500 for printing seventy-five thousand copies of the Special Report on the Diseases of the Horse, one-third for the use of the Senate and two-thirds for the use of the House; Agricultural Experiment Stations, $760,000; Division of Statistics, $140,160, including $10,000 for the investigations on foreign markets; Division of Botany, $28,800; Division of Forestry, $28,520; Division of Agrostology, $18,100; Division of Vegetable Physiology and Pathology, $26,500; Division of Pomology, $16,000; Division of Biological Survey, $27,560; Division of Entomology, $29,500; Division of Chemistry, $29,500, $7,500 of which, as heretofore, is for investigating the adulteration of foods, drugs, and liquors; Division of Soils, $16,300; Nutrition Investigations, $15,000; Public Road Inquiries, $8,000; Division of Seeds, $130,000; Division of Publications, $85,260, of which $35,000 is for the preparation and printing of Farmers' Bulletins; Division of Accounts and Disbursements, $16,300; Library, $12,960; Experimental Gardens and Grounds, $22,500; Domestic Sugar Production, $7,000; Irrigation Information, $10,000; Museum, $2,500; furniture, cases, repairs, and postage, $11,000; and contingent expenses, $25,000.

The total amount of the appropriation is $3,509,202, an increase of $326,300 over the appropriation for the year ending June 30, 1898. The principal increases are for the Weather Bureau and the Bureau of Animal Industry. The Weather Bureau appropriation is increased $53,800, and provision made for the establishment of 16 additional stations and the erection of a small building on the Government reservation at Sault Sainte Marie. There is an increase of $228,200 for the Bureau of Animal Industry for extending the work of inspection and of combating animal diseases, making the appropriation for these purposes $900,000. Hog cholera is mentioned as one of the diseases which may receive attention, and the expenditure of $50,000 is authorized, $25,000 of which is to be immediately available, "for making and using serum for the prevention and cure of hog cholera."

A notable feature of the appropriation for seed distribution is the setting aside of $20,000 for the introduction from foreign countries of seeds, bulbs, trees, shrubs, vines, cuttings, and plants to be used for experimental tests in cooperation with the agricultural experiment stations. This feature is to be in charge of Mr. D. G. Fairchild.

The appropriation for experiment stations includes the usual $30,000 for the Office of Experiment Stations, and $10,000 for agricultural investigation in Alaska, an increase of $5,000. The Alaska work will remain under the supervision of this Office and will be under the immediate charge of Prof. C. C. Georgeson, formerly of the Kansas Experiment Station, who went to Alaska about the middle of April.

The provision for collecting information on irrigation is new and is on a different basis from former appropriations. It is "for the purpose of collecting from the agricultural colleges, agricultural experiment stations, and other sources, including the employment of practical agents, valuable information and data on the subject of irrigation, and publishing the same in bulletin form." This should furnish a basis for procuring data on the strictly agricultural side of irrigation, *i. e.*, the application of irrigation, which, as well as the engineering side, presents a multitude of problems for profitable investigation.

The investigation of domestic sugar production is revived by an appropriation of $7,000 "to enable the Secretary of Agriculture to continue inquiry and ascertain the progress made in the production of domestic sugar from beets and sorghum, including the area of available lands adapted thereto by irrigation or otherwise, and to investigate all other matters concerning the same."

The appropriation for the Division of Botany is increased $5,000 over the previous year, and a new provision made for seed inspection. This authorizes the purchase of samples of seeds in the open market for testing, and, in case they are not found to be up to the standard, the publication of the results of the tests, with the names of the seedsmen.

The amount specified for the Division of Publications does not include the available funds for printing the miscellaneous publications of the Department. This is provided for in a separate appropriation of $85,000, which is a part of the general appropriation for printing.

It will be seen that provision is made for the extension of the work of the Department in several directions. The advantages offered by the experiment stations for supplementing and cooperating in the work of the National Department are more fully recognized in the appropriation act than ever before. To the former provision for cooperation in the study of matters related to human nutrition is now added the testing of foreign introductions, which it is hoped will stimulate investigation on the improvement of agricultural and horticultural plants in general, and studies on the management and use of irrigation. Working hand in hand, the Department and the stations are of great mutual assistance to one another and form a combination for the investigation and promotion of agriculture which is unsurpassed.

ORIGIN AND FORMATION OF ORGANIC MATTER IN PLANTS.

P. P. DEHÉRAIN,

Member of the Institute of France.

By the ordinary method of sand culture, in which the plant is grown in sand free from organic matter, it may be demonstrated that the plant accumulates considerable quantities of carbon and nitrogen during its growth. This carbon and nitrogen with the elements of water form the organic constituents of the plants, which with a small quantity of mineral ingredients make up the roots, stem, and leaves and give the seed its valuable nutritive qualities. Since the soil did not contain either carbon or nitrogen, the plant must have drawn these two elements from the air. It is the purpose of this article to explain the nature of this fixation of the carbon and nitrogen of the air.

ORIGIN OF THE CARBON OF PLANTS.

The classic experiments of Priestley, in 1771, established the fact that plants exhale oxygen. Later researches made by Ingenhous and by Tennebier explained the decomposition of the carbon dioxid of the air and the evolution of oxygen by the leaves under the influence of light. The experimental demonstration of this decomposition is easily made by the method of Cloez and Gratiolet as follows:

Introduce in a liter bottle of white glass 200 cc. of water saturated with carbon dioxid. Fill the bottle with ordinary water and immerse in the liquid branches of such marsh plants as *Elodea canadensis*, *Ceratophyllum submersum*, or *Potamogeton crispus*. Close the bottle with a rubber stopper provided with a tube for drawing off the gas evolved and place in the sunlight. After a few hours a considerable amount of gas is obtained which is rich in oxygen. The green plants therefore draw their carbon from the carbon dioxid and it is important to understand the process by which this is done.

PENETRATION OF THE CARBON DIOXID INTO THE LEAVES.

The earth's atmosphere contains only 3 parts of carbon dioxid in 10,000 of air. It is evident, therefore, that in order that plants may obtain the carbon which they require from a medium so poorly supplied with it rapidity of absorption by the tissues must compensate for the scarcity of the element in the air.

In the first place the absorption of carbon dioxid is favored by the form of the leaves, which is such that they offer, as compared with their weight, an enormous absorbing surface. In a tree the leaves are at the extremities of infinitely ramified, flexible branches, which are agitated by the slightest breeze, thus facilitating contact of the leaves with the constantly renewed layers of air about them. That the absorption of carbon dioxid is very rapid, may be shown by placing a leaf from which the air has been exhausted by means of an air pump in an atmosphere of carbon dioxid in an apparatus[1] which measures the change of the volume. It will be observed that absorption begins instantly, but that it is largely dependent upon the quantity of the water present in the leaf. Thus, the coefficient of absorption of the carbon dioxid in old leaves of Japanese Euonymus, containing 66.3 per cent of water, was found to be 0.70 at 15°, while in young leaves of the same tree containing 75.4 per cent of water the coefficient was 0.83. A comparison, at different temperatures, of the coefficient of absorption of carbon dioxid in the leaves with that in pure water, shows the absorption in the leaves to be somewhat greater than in pure water. This indicates that the carbon dioxid is not simply dissolved in the water in leaves, but that it combines with the water to form a hydrate. It will be shown later that this fact is of great importance.

If a section of the epidermis of a leaf be examined under the microscope, numerous little openings (stomata) will be observed which are generally more abundant on the under side than on the upper side, which is usually covered with a thick, smooth, glossy cuticle. The experiments of Boussingault led to the conclusion, which was long accepted, that the carbon dioxid diffused through the cuticle. F. Blackman[2] has recently demonstrated, however, that the carbon dioxid enters primarily through the stomata.

DECOMPOSITION OF CARBON DIOXID IN LEAVES.

The carbon dioxid which is absorbed by the leaves is decomposed and the products of this decomposition are utilized in the formation of the simplest primary organic compounds, from which the more complex constituents of plants are derived. To accomplish this the principal condition is that the leaf be perfectly healthy. If it does not contain its normal proportion of water, *i. e.*, if the roots do not draw from the soil as much water as is given off through the leaves, the decomposition of carbon dioxid is checked. Assimilation has ceased when as at the end of a summer day the leaves of the tobacco plant, for instance, are hanging down the stem, or those of the beet lie flat on the soil. In fact it has been found that the decomposition of carbon dioxid begins to decline even before the leaves have lost their turgescence.

Light is absolutely essential to the assimilation of carbon by the leaves of plants. The principal source of this energy is, of course, the sun, but attempts have been made to utilize artificial light, especially

[1] Dehérain and Maquenne, Ann. Agron., 12 (1886), p. 525.

[2] Proc. Roy. Soc. [London], 57 (1895), p. 165; Phil. Trans. Roy. Soc. [London], 186 (1895), p. 48 (E. S. R., 6, p. 782).

the electric light for forcing plants. Siemens in England, Bailey in America, and the author in France have made experiments of this character. Since there is no doubt that with the increasing use of water power for the production of electricity, a large supply of electric light can be economically obtained, it is highly interesting to learn what its action is on plants. All observers have found that rays from an arc lamp without a globe exert an injurious influence, blackening the epidermis of the leaves. During the author's experiments in 1881 the epidermis exposed to the direct rays became black, while the parts protected by the upper leaves preserved their beautiful green color. The line of demarcation was as sharp as in a photographic plate. The injurious influence ceased as soon as the lamp was surrounded by a white glass globe through which the ultra-violet rays passed with difficulty. To understand the influence which the heat rays situated at the other extremity of the spectrum exert on vegetation, we must recall to mind that in respiration leaves, like all other plant organs, absorb oxygen and exhale carbon dioxid, a process which is precisely the opposite of that which occurs in assimilation.

It must also be remembered that the activity of respiration increases with elevation of temperature, while rise in temperature has only a very slight effect on assimilation. Maquenne and the author[1] some years ago made a careful study of the action of both light and heat rays on leaves. In this research two sources of light were used, the Drummond light, which is obtained by rendering a piece of quicklime incandescent by means of the oxyhydrogen blowpipe, and the Bourbouze lamp, which is composed of a cylinder of platinum wire gauze, which becomes incandescent when heated with illuminating gas, the combustion of which is promoted by a strong current of air. The leaves were introduced into tubes containing an atmosphere of known composition and were placed very near the lights, but were protected by screens containing transparent liquids of varying diathermanous properties. In some cases water was used, which allowed the light rays to pass but retained the heat rays. In other cases the screens were filled with benzin or with chloroform, which are also transparent but much more diathermanous than water. Exposing the leaves to the action of the Drummond light, which is poor in heat rays, and surrounding them with a screen filled with water promoted reduction, the proportion of carbon dioxid in the tube diminishing, while the oxygen increased. When the screens were filled with chloroform, however, and the Bourbouze lamp was used, which is rich in heat rays, the opposite effect was obtained, *i. e.*, the carbon dioxid increased and the oxygen diminished. In this case the phenomena of respiration took the place of those of assimilation.

Passing from the study of the chemical and heat rays to that of the light rays in the central part of the spectrum, we find that the latter

[1] Ann. Agron., 5 (1879), p. 401.

produce very different effects from the former. Draper demonstrated long ago that the orange rays are the most active in decomposing carbonic acid in the leaves. This conclusion was fully confirmed by the researches of Sachs, Cailletet, and of the author made nearly 30 years ago. The reasons for this special action of the rays of this part of the spectrum were not investigated until the Russian physiologist, Timiriazeff, took up the subject. He found that the rays which are most active in decomposing carbon dioxid are the orange and yellow, which are absorbed by chlorophyll when the latter is examined with the spectroscope. The same fact has been beautifully demonstrated by Engelmann. He received a ray of light upon a prism so placed under the objective of a microscope that on looking through the instrument the different rays of the spectrum could be seen. He then put a drop of water on a slide and added a filament of green alga and some putrefactive bacteria, which were aerobic. It was observed that the bacteria congregated in great numbers on that part of the alga lighted by the yellow and orange rays. In the green region only a few were observed and these finally collected in the blue portion. In other words, the bacteria collected in the different rays in numbers approximately proportionate to their activity in assisting the decomposition of the carbon dioxid by chlorophyll.

Evidently the rays which pass freely through the chlorophyll exert no action. So it happens, as shown above, that the extreme red or the green rays are without effect on the decomposition of carbon dioxid. On the other hand, the orange and blue rays are retained and absorbed by the chlorophyll, and thus made available for the work of decomposing carbon dioxid. The fact that orange rays are much more effective than the blue is easily explained. The decomposition of the carbon dioxid, with the evolution of oxygen, requires an expenditure of energy equal to that involved in the burning of carbon in oxygen. In order, therefore, that the rays may be effective for reducing carbon dioxid they must be not only readily absorbed but sufficiently warm. The orange rays, which are situated at the side of the spectrum where the heat rays are concentrated, are far more energetic than the blue because, in addition to being readily absorbed, they are warmer than the latter.

The decomposition of carbon dioxid can only be brought about by the aid of outside energy. This energy is supplied by the sun's rays. Since decomposition of carbon dioxid in the chlorophyll cells is the source of the organic constituents of plants, and since these substances are essential to the life of animals, we see that all living beings on the earth's surface owe their activity primarily to the sun.

PRODUCTION OF CARBON COMPOUNDS BY DECOMPOSITION OF CARBON DIOXID.

It does not suffice to know that the leaves, saturated with water, absorb the carbon dioxid of the air and under the influence of the sun's rays evolve oxygen. It is necessary to define this process and to explain how organic matter is derived from the product of this decomposition.

Boussingault demonstrated that when one volume of carbon dioxid is decomposed by the leaves under the influence of sunlight one volume of oxygen results; that is, precisely the amount contained in one volume of carbonic anhydrid.

Maquenne and the author, in the article already referred to, report the result of studies on the quantities of carbon dioxid absorbed by leaves, taking into account also the quantities which would be absorbed by a volume of water equal to that contained in the leaves under experiment. The results, as already stated, indicated that the absorption is not simple solution of carbonic anhydrid in the water of the leaves, but a chemical combination of the carbon dioxid with water to form the acid CH_2O_3. This carbon dioxid decomposes in the leaves, giving off a volume of oxygen (O_2) equal to that of the carbonic anhydrid absorbed as observed by Boussingault, and leaving a residue of formic aldehyde (CH_2O). The fact that formic aldehyde has never been found in plants might be taken as casting doubt upon the correctness of the above hypothesis, but the hypothesis is strengthened by the fact that the molecules of this aldehyde combine easily with each other; and although we do not find formic aldehyde itself we may safely assume that some at least of the bodies present are the result of combinations of molecules of formic aldehyde. As a matter of fact bodies which might be thus formed are extremely abundant in the vegetable kingdom, as will be seen hereafter. It is known also that the aldehydes combine readily with oxygen and hydrogen and it is of great interest to ascertain whether there are not present in plants some products thus derived from formic aldehyde. As a matter of fact such substances have been found. By oxidation formic aldehyde yields formic acid, which gives to nettles their irritating properties. The addition of hydrogen to formic aldehyde in proper proportions yields methyl alcohol, which Maquenne found in all the plants which he studied.

While the presence in plants of these two compounds so closely allied to formic aldehyde supports the hypothesis of the formation of this aldehyde in the chlorophyll cells at the moment of the decomposition of the carbon dioxid by the sun's rays, there are other proofs of a more convincing nature. The reducing sugars are widely distributed in plants. Loew, and later Fischer, starting with formic aldehyde, have prepared these sugars artificially. They succeeded in linking together six formic aldehyde molecules, and thus formed a reducing sugar resembling those found in plants. This beautiful synthesis convinced the physiologists that the primary organic compound from which all the others are derived is formic aldehyde produced by the decomposition of the hydrated carbon dioxid. Many other compounds common in plants are formed by the combination of molecules of formic aldehyde, such as glycerin, which exists in all oils and which contains three molecules of formic aldehyde combined with hydrogen; the gums, which readily yield a sugar containing five molecules of formic aldehyde, and persite, found in the fruit of the alligator pear, which contains seven molecules of the aldehyde.

Starch is easily transformed into glucose by simply heating the starch with weak acid solution. This in fact is the method employed in the commercial preparation of glucose. Starch is also transformed into glucose during germination by the action of a ferment present in the seed. This change is so easy and so frequent that there is no doubt that the transformation could be reversed; that is, the glucose could be changed into starch. Up to the present time, however, this has not been done by purely chemical means, but when leaves are placed in a solution of glucose starch soon appears in them. The starch is formed from the glucose through the combination of several molecules of the latter, water being eliminated.

Starch is very abundant in leaves which have been exposed to sunlight. Its presence is more easily detected than that of glucose. The latter is but a transition stage, while the starch is reserve material which remains in the tissues much longer than glucose.

The starch which is so abundant at the end of the day disappears during the night. The leaf is thus seen to be both a laboratory and a storehouse which is continually emptying and filling itself. The starch disappears from the leaves in the form of glucose. Adult plants utilize this transfer form of starch in the formation of cellulose, just as young plantlets utilize the glucose formed from starch in the cotyledons of the seed during germination.

The different steps have now been traced in the formation of the organic matter of plants from the simple carbon dioxid absorbed to the complex carbohydrates of the plant tissues. It now only remains to briefly discuss the derivation of some particular forms of these carbohydrates. Among the most important of these is cellulose, which forms the envelope of the cells and which is easily changed into reducing sugars under the action of acids. It appears during the germination of seeds simultaneously with the disappearance of starch. There is little doubt that it is derived from glucose and consequently from formic aldehyde. It seems clear, therefore, that all the carbohydrates, the gums, sugars, starch, inulin, and cellulose originate in the activity of the chlorophyll cells. The same is probably true of the tannin and resin groups. There are, however, certain plants which contain a group of sugars known as the inosites which are true carbohydrates, but whose molecular construction is different from that of the other glucoses, since their derivatives belong to the aromatic series and not to the fatty acid series to which the other groups belong.

There is one other important point which needs some explanation. If we study the phenomena of assimilation in a leaf which has been exposed to sunlight, we will find that the volume of oxygen evolved equals that of the carbonic acid decomposed. The plant utilizes the carbon, but the proportion of oxygen which it contains remains unchanged. This is not true, however, when we determine the changes in composition which the air in which a plant is living undergoes. Schloesing found that under such conditions the volume of oxygen evolved was larger than the volume of carbon dioxid absorbed. This indicates that the evolution of oxygen is not due simply to decomposition of carbon dioxid. Doubtless the greater part of this excess of oxygen is due to reduction of nitrates which the plants take up from the soil, but, as is shown below, a study of plant respiration reveals another source of oxygen.

PLANT RESPIRATION—THE FORMATION OF SUBSTANCES RICH OR POOR IN OXYGEN—FATTY SUBSTANCES, RESINS, AND VEGETABLE ACIDS.

By the term respiration we understand the phenomena of the absorption of oxygen and the evolution of carbon dioxid. Respiration occurs in all plant organs and is a function of such importance that when interfered with by the exclusion of oxygen the death of the plant results. If the roots, buds, moistened seeds, and branches of a plant be placed in a flask and a current of air free from carbon dioxid be passed over them and then led through a solution of barium hydrate, the latter will become milky, due to the formation of barium carbonate, thus showing that the vegetable matter has evolved carbon dioxid. The leaves throw off carbon dioxid except when they are exposed to the light and respiration is masked by assimilation. During the night or in dense shade they throw off carbon dioxid. When the relation between the oxygen absorbed and the carbon dioxid evolved is carefully determined, it is found that this relation is considerably modified by the temperature to which the leaves are exposed. In a low temperature the oxygen absorbed is usually greater than the carbon dioxid evolved, while in a high temperature the reverse is true, that is, there is more carbon dioxid evolved than oxygen absorbed. Since one volume of carbon dioxid contains exactly one volume of oxygen it is evident that when the volume of carbon dioxid evolved is greater than the oxygen absorbed the plant is losing oxygen. This explains how the glucoses which are found in the pods of colza are transformed into the fatty substances of the seed and how inosite and its derivatives formed by chlorophyll action in caoutchouc trees give a resin which is devoid of oxygen. The nature of this transformation has not yet been explained, but the above observations indicate that these substances, like starch, cellulose, and sugar, are derived from formic aldehyde, which, as already explained, is assumed to be the primary substance from which all plant substances are built up.

The formation of acids in plant tissues is explained more easily than that of fatty substances and resins. When starch or sugars are subjected to the action of dilute nitric acid, oxalic acid is produced. Similar treatment of other saccharine bodies results in the production of tartaric acid. Plant acids are due to a partial oxidation of neutral substances. When the carbohydrates oxidize at a low temperature or the penetration of oxygen into the tissues of the plant is interfered with by the structure of the organs, combustion of the neutral substances is not complete, *i. e.*, they are not reduced to carbon dioxid and water. In this case the oxygen combines with the substances to produce the acids. For example, considerable amounts of oxalic acids and oxalates are found in the juice of the cactus, especially the prickly pear, which is but slightly permeable to air. When, therefore, the volume of oxygen absorbed is greater than the volume of carbon dioxid evolved it may be assumed that oxygen has been fixed by organic compounds in the plant to produce acids. These acids, then, are derived from neutral substances by oxidation, and, consequently, trace their ultimate origin to the decomposition of the carbon dioxid in the chlorophyll cells.

ORIGIN OF THE NITROGEN IN PLANTS.

ORIGIN OF THE NITROGEN IN LEGUMINOSÆ.

In the experiment to which attention was called at the beginning of this article it would have been impossible to grow peas without adding a few cubic centimeters of an infusion of fertile soil to the sand. If this precaution were not observed with the peas or if the seed of some nonleguminous plant were used the experiment would be a failure. The seed would produce a sickly plant which would soon die of starvation due to the absence of one of the elements—nitrogen—necessary to its development. Although the leaves of plants grow in an atmosphere four-fifths of which is nitrogen they are entirely incapable of directly utilizing this element.

The process by which the free nitrogen of the atmosphere is utilized by plants has only been explained in comparatively recent years. Hellriegel and Wilfarth in 1886 reported experiments which demonstrated the ability of Leguminosæ to attain normal development in soil absolutely deprived of organic matter, the only precaution necessary being the addition of a small amount of an infusion of fertile soil. A few weeks after the addition of the infusion the roots of the leguminous plants were covered with tubercles which microscopic examination showed to be filled with micro-organisms. Bréal has shown that inoculations may readily be made with these organisms by pricking a tubercle with a needle and then inserting it into a growing root.

The tubercle bacteria have been cultivated and their products have recently been brought into commerce under the name of "Nitragin," which is used for supplying these organisms to soils which are deficient in them. The growth of leguminous plants in sterile sand depends upon the presence on their roots of tubercles filled with these organisms. Through their agency the plant is supplied with nitrogen for the production of nitrogenous matter, so that if the mineral elements are present in sufficient quantity the plant makes normal growth. The plant profits by the nitrogen furnished by the bacteria while the latter utilize the carbonaceous matter supplied by the plant, thus establishing a symbiosis. Although the process of fixation of nitrogen by the organisms and its utilization by the plant has not yet been clearly explained, we can understand how that, notwithstanding the great quantities of nitrogen carried away from the soil with every cutting of alfalfa or clover, the amount of nitrogen in the soil increases rather than decreases.

ORIGIN OF THE NITROGEN OF NONLEGUMINOUS PLANTS.

It has been shown by numerous analyses that soils abandoned for centuries to natural vegetation in which grasses predominate are quite rich in nitrogen. There are mountain meadows in France which during the open season are grazed by milch cows, and although this involves the removal of a considerable amount of nitrogen, and no fertilizers are used, these soils constantly increase in nitrogen content. While soils which are continuously cultivated frequently contain not more than 1½ to 2 parts per thousand of combined nitrogen, permanent meadows contain 5, 7, 9, and even 10 parts per thousand. The prairies of Western America are also well stocked with nitrogen. It is interesting to trace the origin of this nitrogen.

Although the investigations of Ville and Atwater and those at Rothamsted and Grignon had proved that free nitrogen intervenes in the phenomena of vegetation, the process of fixation of nitrogen in the soil was not understood until explained by Berthelot, who showed that nitrogen is fixed in the soil by bacteria. Winogradsky cultivated certain of these bacteria in sugar solution and found that they decomposed the solution, forming butyric and acetic acids and evolving carbon dioxid and hydrogen. They are therefore very similar to if not identical with the organisms studied by Maquenne and the author in 1882[1] and which decomposed sugar as explained above. The latter investigators, however, had no idea at that time that the ferments were able to fix the nitrogen of the air, and the investigation is mentioned simply to call attention to the fact that these ferments are very widely diffused, since they were found in all the soils studied. These organisms are all anaerobic, and it would seem suprising that they should grow in a medium so thoroughly aerated as arable soil; but this has been explained by Winogradsky as follows: The organisms which fix nitrogen are capable of action only when associated with certain common species of organisms which are capable of oxidizing organic matter and which thus surround the anaerobic forms with an atmosphere charged with carbon dioxid and deprived of oxygen. Winogradsky further suggests that the hydrogen set free in the

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[1] Ann. Agron., 9 (1883), p. 5; 10 (1884), p. 5.

decomposition of the carbohydrates furnishes ammonia, which is assimilated by the micro-organisms and used in the formation of tissue. It is not, therefore, simply the nitrogen which has recently been drawn from the air which is utilized by plants. They assimilate also the nitrogen derived from vegetable and animal remains.

The work of Pasteur has shown that the action of micro-organisms is necessary to the transformation of the complex organic substances of the tissues of living plants into the simple forms which may be assimilated by plants. Without these organisms life would be impossible, as Pasteur himself has said, because the work of death would be incomplete. By their intervention the complex substances are burned, the carbon passing into the form of carbon dioxid, the hydrogen into water, and the nitrogen into ammonia; and in these different forms the matter is again carried into circulation.

It often happens that vegetable matter remains for a long time in the form of humus; but even in this form it is utilized by plants. The humus is constantly subjected to the oxidizing action of the lower organisms and undergoes gradual decomposition. The ammonia produced by the decomposition of the humus is assimilated by plants as well as the readily available product of oxidation, nitric acid.

Schloesing and Müntz 20 years ago showed that nitrates are formed in the soil by the action of organisms. More recently Winogradsky has demonstrated that the action of two different organisms are necessary for the transformation of ammonia into nitrates—one converts ammonia into nitrites and the other completes the oxidation, producing nitrates. We thus see that micro-organisms seize upon the nitrogen of the air and convert it into organic compounds; they convert vegetable matter into humus, and then break down this humus, producing ammonia and finally nitrates. At every step they perform a useful work, and are valuable auxiliaries of agriculture.

There are, however, other organisms which interfere with the work of the beneficial kinds. Bréal observed several years ago that there is an aerobic organism which decomposes nitrates and sets elementary nitrogen free. This organism is abundant in vegetable débris, especially in straw. It is also encountered in the excrement of domestic animals. The extent to which the losses of nitrogen in arable soils is due to the action of this denitrifying organism and the conditions most favorable to its action are questions which require further investigation.

THE DIFFERENT FORMS IN WHICH NITROGEN IS UTILIZED BY PLANTS.

If we follow the example of Boussingault and plant a sunflower seed in a sterile soil to which the necessary mineral matter and increasing amounts of nitrates are added, or if we repeat the experiment of Hellriegel and plant barley in well-washed sand to which sufficient mineral matter and increasing amounts of calcium nitrate are added, we will find that the crop produced increases with the amount of nitrate added. In Hellriegel's experiments less than 1 gm. of dry matter was produced when nitrates were not added, the production of dry matter increasing to 25 gm. when sufficient nitrates were supplied.

These experiments, however, simply demonstrated in an exact manner facts which were already well known in practice. The consumption of nitrate of soda would never have reached its present enormous proportions if farmers had not learned to appreciate the efficacy of nitrates as a fertilizer. At the present time they enter into all fertilizer formulas. The application of this fertilizer is necessary, because we are not yet able to so control nitrification in the soil that it can be made to furnish sufficient nitrates for the demands of the crop at exactly the time in the spring when they are most needed. Nitrates are produced only in warm and moist soils, and they are found in the drainage water in larger proportion in autumn than in any other season. Fortunately the roots of living plants have great capacity for retaining the nitrates and thus reduce the loss in drainage.

If wheat roots are drawn from the soil during the winter, dried, and soaked in sulphate of diphenylamin they will take on a deep blue coloration. The amount of nitrates contained in wheat roots is surprisingly large. The author has found as much as 1 per cent in dried roots, but the proportion decreases as growth advances. They pass from the roots to the stems and then to the leaves, where they are used in the formation of albuminoid substances. It might be a matter of surprise that substances which are so easily soluble in water as the nitrates can nevertheless be taken up and retained by roots even when surrounded by moist soil. Demoussy has shown that nitrates can not be removed from the roots by washing in cold water, but are extracted when the roots are treated with warm water or when they are subjected for some time to an atmosphere of chloroform and then washed with cold water. It appears, therefore, that the nitrates penetrate by osmosis into the interior of the cells and form unstable combinations with the protoplasm, resuming their normal state only when the protoplasm is modified by elevation of temperature or the action of chloroform.

Experience has shown that whether nitrates are formed in the soil by the action of micro-organisms or introduced in the form of fertilizers they exert a decided influence upon the crop. Nitrates are not formed in soils like those of meadows or forests, which are highly charged with decaying organic matter, since these soils are acid and therefore do not furnish a suitable medium for the nitric ferment. Liming renders such soils more favorable to the activity of the nitric organisms.

In meadow and forest soils nitrogen appears to be taken up by plants in the form of ammonia. Müntz,[1] Bréal,[2] and Pagnoul[3] have reported

[1] Ann. Sci. Agron., 1896, I, No. 2, p. 161.

[2] Ann. Agron., 22 (1896), p. 485 (E. S. R., 8, p. 386).

[3] Ann. Agron., 19 (1893), p. 274.

experiments which indicate that nitrogen is easily absorbed by plants in this form. Bréal[1] has shown that nitrogen is also taken up by plants in the form of humates of lime or potash.

Hellriegel has shown in experiments with barley fertilized with variable amounts of nitrates that the amount of water transpired by the plant per gram of dry matter increases as the amount of nitrate applied decreases. Barley, which received the most favorable amount of nitrates, evaporated 263 gm. of water per gram of dry matter produced. The plants which received no nitrates and which made a sickly growth evaporated from 700 to 800 gm. of water per gram of dry matter. Normal, vigorous plants obviously evaporate more water than sickly ones, but if we calculate the ratio of the quantity of water transpired to the weight of dry matter produced we find that the proportion is greater in the sickly than in the vigorous plants. This fact may be useful in determining the efficacy of a fertilizer.

By pursuing this method of investigation the author found that the Gramineæ and Leguminosæ do not take up and utilize plant food in the same manner. The Gramineæ are especially benefited by chemical fertilizers, particularly nitrates, while they do not utilize humus substances to very great advantage. On the other hand, Leguminosæ are more benefited by the humates than by nitrates or ammonia salts.

Rye grass and clover were planted in large pots, each of which contained 50 kg. of soil exhausted by continuous cropping. Equal amounts of phosphoric acid, potash, and nitrogen were applied. In one case the nitrogen was applied in the form of nitrates, in the other in the form of humate. A black extract from manure which contained a mixture of humate of potash and humate of ammonia was also used. At the end of the experiment it was found that the rye grass which had received no manure had transpired 682 gm. of water per gram of dry matter, that which had received humates 435 and 469 gm., and that which had received only chemical fertilizer 233 gm. The results were quite different with clover. In this case the transpiration was: Without manure 454 gm., with chemical fertilizers 398 gm., and with humates 272 and 265 gm. These results confirm the conclusions of Bréal, Snyder, and Lawes and Gilbert. The latter have shown at Rothamsted that it was impossible to grow clover continuously on the same land unless the soil was abundantly supplied with organic manures.

To summarize, then, nitrogen is taken up by plants in the form of nitrates, ammonium salts, and alkaline humates. The Leguminosæ can utilize free nitrogen only when it has been brought into combination by the action of the organisms of the root tubercles. It has frequently been claimed that other plants besides the Leguminosæ are capable of absorbing free nitrogen, but it has been shown that this absorption does not take place without the intervention of the organisms which fix nitrogen.

[1] Ann. Agron., 20 (1894), p. 353 (E. S. R., 6, p. 284).

FORMATION OF NITROGENOUS MATTER.

This is a subject of which little is known. A study of the changes which take place in the atmosphere surrounding a plant shows that the ratio of carbon dioxid absorbed to oxygen evolved is much less than unity. Since in a study of assimilation in a detached leaf Boussingault found this ratio to be equal to unity it is natural to attribute the larger part of the excess of oxygen thus found to reduction of nitrates; for if the chlorophyll cell is capable under the influence of sunlight of reducing so stable a compound as carbon dioxid it is fair to assume that it could more easily reduce nitric acid. It is probable that the nitric acid is transformed into ammonia which unites with carbohydrates to form amids, which by successive steps are transformed into the complex albuminoids. This, however, is simply an hypothesis which is not based upon exact observation.

CONCLUSIONS.

When Priestley in 1771 made the discovery that plants purify an atmosphere which has been vitiated by the respiration of animals he proclaimed the solidarity of two kingdoms, an idea which gradually took definite shape.

Plants, agents both of reduction and of synthesis, decompose the carbon dioxid of the air under the influence of sunlight and elaborate organic matter, while the animal burns this organic matter and exhales the carbon dioxid which nourishes the plant. The plant stores up in its reserve materials the energy drawn from the sun and the animal consumes these materials, converting the energy into heat and work.

Our views regarding this subject were broadened by the investigations of Pasteur, who demonstrated that the innumerable plants without chlorophyll as well as the micro-organisms which swarm in the soil are, like animals, destroyers of organic matter and producers of carbon dioxid. Indeed, it seemed at first that their rôle was simply to "complete the work of death," reducing the organic matter to those simple forms which can be utilized by plants. One of their most important functions, however, was ignored until Berthelot showed that these organisms are not only agents of reduction, but that some of them are agents of synthesis which draw into the cycle of life the most refractive of elements—nitrogen—while others have the power of fixing the free nitrogen of the air. The solidarity of living beings thus appears under another form. The fixers of nitrogen live and work only to destroy the organic matter elaborated by the fixers of carbon—the chlorophyll plants.

If the tree holds sway on the plains, proudly spreading its branches; if the valleys are covered with bright colored herbage; if the reaper gathers the golden sheaves, it is due to the humble workers hidden in the depths of the soil, one class fixing the nitrogen in complex combinations, and others taking up this matter, simplifying it, and converting it into ammonia and nitrous and nitric acids. Others, again, of which we are just beginning to learn, destroy this work and set the nitrogen free. A part of the work accomplished, however, is not undone, for the nitrates which are taken up by the roots rise to the leaves and help form the complex substances necessary to animal life.

Although the plant profits by the work of the micro-organisms, it assists them in its turn. The roots of the plant and its discarded leaves falling like a beneficent rain furnish the carbonaceous matter necessary to the life and work of the fixers of nitrogen.

The harmony of nature increases in beauty as we slowly arrive at a better understanding of it, and our admiration increases with the new knowledge of the solidarity of the fixers of nitrogen and the fixers of carbon, which mutually assist each other and insure the continuance of life upon the surface of the earth.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

A contribution to the method of extracting fat, E. VOIT (*Ztschr. Biol., 35 (1897), No. 4, pp. 555–582*).—It has been claimed that the method of determining fat in meat by extraction with ether does not give accurate results. The author reports in detail the ether-extraction method ordinarily followed at Munich which he believes to be reasonably accurate. This differs in some points from that in use elsewhere. It is as follows: Duplicate samples of meat are dried on a water bath at a temperature under 80° C. The substance thus dried often absorbs water when pulverized, therefore it is treated with sufficient alcohol to render it crummy and then dried until the odor of alcohol is no longer noticeable. After standing for some time covered but accessible to the air it is pulverized. Samples of the material thus prepared are used for further analysis.

A number of experiments were made by Krummacher to test the accuracy of this method as compared with the digestion method of estimating fats as proposed by Dormeyer (E. S. R., 7, p. 919). The conclusion was reached that when the extraction with ether was properly carried out with small quantities of substance as free from water as possible 24 hours extraction was sufficient. In the majority of cases extraction with ether alone removed all the fat. It is certain that 95 per cent of the fat may be so obtained, and this method may be used unless greater accuracy is desired. There are still sources of error in the method of extraction by ether which are not understood.

On the determination of fat and casein in feces, H. POOLE (*Jour. Amer. Chem. Soc., 19 (1897), No. 11, pp. 877–881*).—In connection with the study of the feces of a child fed an exclusive milk diet the author proposes tentatively the following method of determining the fat and casein. The ether extract of the dried feces, which contains both fat and cholesterol, is evaporated until nearly dry at 100° and then heated to 110° until dry. It is then saponified with alcoholic potash, water added, and the mixture boiled to expel the alcohol. The filtered solution, which should be clear and opalescent, is extracted with ether several times to remove the cholesterol. The aqueous solution is evaporated until nearly dry and then taken up with water, the fatty acid being determined by any of the usual methods.

To determine the casein the feces are extracted with ether, water, and alcohol, then dried and digested with hydrochloric acid (70 per cent water) for several hours at about 50°. The casein is dissolved, leaving the epithelial cells and other matter undissolved. After evaporating the hydrochloric acid solution the nitrogen is determined by the Kjeldahl method and the casein calculated.

Chemical and bacteriological investigations on the fermentation of fresh grass, O. EMMERLING (*Ber. Deut. Chem. Gesell., 30 (1897), p. 1869; abs. in Chem. Ztg., 21 (1897), No. 89, Repert., p. 256*).—Fresh grass was packed in a large covered earthenware jar. After 24 hours the temperature of the grass increased to 26° C., as shown by a thermometer in the cover of the jar. It remained for some time fairly constant at this temperature and then decreased slowly to room temperature. For four weeks there was a slow but constant evolution of gas made up of 63 per cent carbon dioxid and 36 per cent nitrogen. No methan was detected. When removed from the jar the grass had a brownish color, acid reaction, and an odor resembling an ester. As shown by analysis, the amount of nitrogen free extract and protein was diminished, the other constituents being relatively increased. Chinon was identified in the ether extract. The bacteria found and the chemical decomposition of the constituents of the grass due to their action are discussed.

The preparation of a carbohydrate from egg albumin, J. G. SPENZER (*Ztschr. Physiol. Chem., 24 (1898), No. 4, pp. 354–357*).

Microscopic examination of w ter, C. MEZ (*Mikroskopische Wasseranalyse. Berlin: J. Springer, 1897*).—A manual giving especial attention to the analysis of potable water and sewage. The micro-organisms in fresh water are discussed.

Contribution to the microscopical examination of foods and feeding stuffs, A. HEBEBRAND (*Forsch. Ber. Lebensmtl., 4 (1897), No. 11, pp. 306, 307*).

Detection of formalin in food (*Ztschr. Nahr. Untersuch. u. Hyg., 12 (1898), No. 2, pp. 29, 30*).

Apparatus for rapid and accurate determination of milk fat, ELLENBERGER (*Ztschr. Nahr. Untersuch. u. Hyg., 11 (1897), No. 22, pp. 373, 374, fig. 1*).

Experiments on the amount of lead in tin plate and canned goods, P. CARLES *Jour. Hyg., 23 (1898), No. 1116, pp. 64–66*).—A method of estimating lead electrolytically as PbO_2 is recommended.

Introduction to the chemical analysis of wines, E. BORGMANN (*Anleitung zur chemischen Analyse des Weines. Wiesbaden: C. W. Kriedel, 1897, 2. ed. by Th. W. Fresenius*).

Experience in the analysis of sweet wines, E. VON RAUMER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 1898, No. 1, p. 49; abs. in Chem. Ztg., 22 (1898), No. 9, Repert., p. 19*).

Determination of acid in beer and other liquids containing acid phosphates, A. OTT (*Ztschr. Gesam. Brauw., 20 (1897), p. 540; abs. in Chem. Ztg., 22 (1898), No. 9, Repert., p. 19*).

Reflux condensers, B. H. HITE (*West Virginia Sta. Rpt. 1896, pp. 64, 65, fig. 1*).—A condenser designed for use over beakers is described. "[It] consists of a round flask with a short neck, closed by a two-hole rubber stopper, through which passes the inlet and outlet tubes. The inlet tube extends nearly to the bottom of the flask, the outlet tube about halfway to the bottom, and upon the depth to which the outlet tube is inserted into the flask may be made to depend the depth of the water in the flask, as the space above the lower end of this tube is filled with air. . . . The condenser rests on the mouth of the beaker and requires no other support."

Apparatus for extracting with ether, B. H. HITE (*West Virginia Sta. Rpt. 1896, pp. 60–64, pl. 1*).—An apparatus is described which follows automatically the method of washing on the filter, allowing one quantity of solvent to run through before another is added, thus combining the advantages of the siphon and percolator classes of extractors. All joints with which the ether comes in contact are closed with mercury. The rate of siphoning is easily controlled in the apparatus described and the solvent is recovered "without the use of any accessory apparatus and without the loss which is always incurred by opening an extractor to attach the accessories. The recovered ether is retained immediately under the condenser, where there is little danger of loss."

Drying apparatus, B. H. HITE (*West Virginia Sta. Rpt. 1896, pp. 57–60, pl. 1*).—A convenient apparatus for drying in hydrogen is described in detail.

Chemical division, H. J. WHEELER (*Rhode Island Sta. Rpt. 1896, pp. 211–220*).—A brief summary of the work of the year in this department of the station, including analyses of wood ashes, slag, floats, aluminum phosphates, superphosphates, raw and dissolved bone, tankage, Peruvian guano, dried blood, sulphate of ammonia, nitrate of soda; nitrate, carbonate, muriate, and sulphate of potash; soda ash, common salt, Epsom salts, refuse from soap works, wool waste, mangel-wurzels, sugar beets (limed and unlimed), Fungiroid, and water.

BOTANY.

The relation of nutrient salts to turgor, A. B. COPELAND (*Bot. Gaz., 24 (1897), No. 6, pp. 399–416*).—It is claimed that turgor can not supply the energy necessary for growth, since growth occurs without turgor stretching, and abnormally slow growth is more likely to increase and rapid growth to decrease turgor than be influenced by it. However, turgor probably plays an important function in plant economy.

The author has investigated by means of water cultures *Phaseolus multiflorus*, *P. vulgaris*, *Pisum sativum*, *Sinapis alba*, *Fagopyrum* sp., and *Zea mays* noting the effect of various salts on the turgor of the plant. While various compounds were used, the effect of potassium and sodium were principally noted. It was found that potassium presented in solution to the roots of plants causes the cells of both root and stem to exhibit a higher turgor than they do when it is replaced by sodium. This seems to indicate that potassium is a direct factor in the turgor of the plant, and there seems to be no experimental ground for attaching this significance to any other constituent of the mineral food of plants. When offered to the roots, potassium is taken up and stored in the cell sap where it becomes an important part of the osmotically active material which keeps the cell and plant turgid. This function is not shared by sodium, which is considered useless to the plant.

Homology of organs as shown in cuttings, L. C. CORBETT (*West Virginia Sta. Rpt. 1896, pp. 194–196, pls. 2*).—The author reports upon cuttings grown from potato plants in which about 5 in. of the topmost portion of the growing branches were removed. These cuttings took root readily and small tubers appeared either at the cut surface where the roots develop or from the axil of the leaf, the latter being the more common place. As soon as these tubers were fully matured the roots and top of the original cuttings began to dry up. When cuttings were used in which no joints or nodes were placed under the soil the tubers developed from the axils of the leaf in every case. It was demonstrated that the aerial tubers would germinate and produce tops, but the resulting tubers were never larger than those planted.

Similar experiments were conducted with *Stachys floridana*, in which tubers were developed in the axils of the leaf even before the cuttings had made root, but they were never produced above ground.

Increase of the nitrogen of the soil by white mustard, S. VON KOWERSKI (*Inaug. Diss., Halle, 1895; abs. in Jour. Chem. Soc.* [*London*], *72* (*1897*), *No. 421, II, p. 590*).—A number of pot experiments were made in which white mustard was grown in 2 lots of arable soil containing 0.1149 and 0.1261 per cent of nitrogen, respectively. There were also 2 pots in which peas and mustard were grown together. The pots were sterilized, but no attempt was made to maintain their sterility, the whole experiment being conducted out of doors. Each of the pots received an equal quantity of sodium nitrate as well as mineral manure and each showed a gain of nitrogen. The gain was from 2 to 7 times greater in the unsterilized than in the sterile soil, and there was also a greater gain of nitrogen under the influence of nitrogenous manure than when the soil was unmanured. The author concludes that the fixation of free nitrogen took place through the influence of the microorganisms present in the soil, the white mustard itself not being able to assimilate elementary nitrogen. Peas grown in rich soil do not assimilate free nitrogen even when their roots bear well developed tubercles.

The permeability of tree trunks to gases, H. DEVAUX (*Compt. Rend. Acad. Sci. Paris, 125* (*1897*), *No. 23, pp. 979–982*).—By means of a specially devised apparatus the author has been able to observe a very considerable gaseous exchange between tree trunks and the air.

He found that on the larger trunks lenticels are abundant and they are frequently larger and more open than on the smaller branches. In some trees such as *Picea excelsa* and *Populus alba* the lenticels are well-developed yet they are almost completely closed for the most of the time.

The author states that the crustaceous lichens which often cover tree trunks do not sensibly affect the gaseous exchange through the lenticels.

Root tubercles in water cultures, H. A. WEBER (*Jour. Amer. Chem. Soc., 20* (*1898*), *No. 1, pp. 9–12, fig. 1*).—A form of apparatus that has proved very efficient in studying the development of root tubercles is described and figured. Plants can be grown in any kind of culture medium. The apparatus secures a constant level and thorough aeration of the culture medium and peas have been readily grown to fruiting in it.

An experiment with peas is briefly described. In it one lot of plants was grown in a complete solution, a second in the same solution but without any nitrogen, and the third lot the same as the second with the addition of an infusion of soil where peas had been grown. No. 1 grew well, No. 2 died of nitrogen starvation, and No. 3 grew well for about 10 days, when the plants began to show appearances of nitrogen starvation and no tubercles were visible. A few days later the plants began to recuperate and the growth became normal and vigorous. On the fifteenth day tubercles were abundant.

[The author is in error in saying that the subject of nitrogen assimilation has only been studied in connection with sterilized soil or sand, as water cultures have been employed by Hellriegel, Hiltner, Frank, Lotsy, and others.—ED.]

The tensile strength of cell walls, H. H. DIXON (*Ann. Bot., 11 (1897), No. 40, pp. 585–588*).—The author has conducted a series of experiments to ascertain the coefficient of safety against osmotic pressure in plant cells. From data collected from the breaking stress of fibers of cotton and other plants and comparing the area of these fibers with those of the cell walls of many plants he finds that every cell of the leaf is able to sustain the high osmotic pressures which give rigidity to the leaf and, so far as the strength of the cell walls is concerned, much higher pressures might exist.

On the composition of the membranes of some fungi, C. TANRET (*Bul. Soc. Chim. Paris, 3. ser., 17 (1897) No. 20–21, pp. 921–927*).—After treating the mycelium of *Aspergillus niger* with water, alcohol, ether, cold caustic soda, and sulphuric acid, the author states that chitin is present associated with a carbohydrate called fungose, which is similar to, if not identical with that found in yeast, ergot, agarics, and boletus. Having been found in such dissimilar fungi the author believes that fungose is a constituent of the membranes of all fungi.

The plants of saline soils, A. FERET (*Monde des Plantes, 2. ser., 7 (1897), No. 96, pp. 193–195*).

Plants and their environments, J. COSTANTIN (*Le végétaux et les mélieux cosmiques. Paris: F. Alcan, 1898, pp. 296, figs. 296*).

A revision of the diagnosis of the species of Hymenomycetes, M. BRITZELMAYR (*Bot. Centbl., 73 (1898), Nos. 5, pp. 129–135; 6, pp. 169–175*).

Critical studies of the North European forms of Agrostis, A. S. MURBECK (*Bot. Notiser, 1898, No. 1, pp. 1–14*).

The effect of drought upon certain plants, CLARA CUNNINGHAM (*Proc. Indiana Acad. Sci., 1896, pp. 208–213, pls. 2*).—An experimental study was made on the effect of drought on the different tissues of plants, the subject of the experiments being oxalis, canna, corn, beans, castor beans, and cucumbers.

Development of roots from cuttings, L. C. CORBETT (*West Virginia Sta. Rpt. 1896, pp. 196–199, pls. 3*).—The author discusses the development of roots from cuttings, and states that they do not have their origin in the callus, but grow from the fundament formed in the tissue of a portion of the plant used as a cutting in a similar manner to that of the development of new roots from the root or the plant axis of a seedling.

A device for measuring plant growth, L. C. CORBETT (*West Virginia Sta. Rpt. 1896, pp. 236–240, pl. 1*).—The author figures and describes a form of auxanometer for which the advantage of a record made in ink in the form of a platted curve is claimed.

On the artificial pollination of conifer flowers, VON ST. PAUL (*Mitt. Deut. Dendrol. Gesell., 1897, No. 6, pp. 44–46, fig. 1*).

Method of the formation of cellular membranes, L. QUERTON (*Ann. Soc. Belge Micros., 22 (1897), No. 1, pp. 59–74*).

Experimental researches on the assimilation of ammoniacal and nitric nitrogen by the higher plants, M. LAURENT (*Ann. Sci. Agron., 1897, II, No. 2, pp. 175–212*).—Reprinted from Bul. Acad. Roy. Sci. Belg., 1896, No. 12 (E. S. R., 9, p. 325).

The action of ammonium salts on Aspergillus niger, C. TANRET (*Bul. Soc. Chim. Paris, 3. ser., 17 (1897), No. 20–21, pp. 914–921*).—The author experimented with the nitrate, sulphate, chlorid, and phosphate of ammonia, and found the fungus was able to absorb certain quantities of these salts, part of which was utilized, and the rest thrown off.

The pigmy panic grass (Panicum pygmæum), J. H. MAIDEN (*Agr. Gaz. New South Wales, 9 (1898), No. 1, p. 32, pl. 1*).—Descriptive notes of this grass, which is said to be valuable in rather dense shade.

FERMENTATION—BACTERIOLOGY.

Concerning a ferment of cellulose, V. OMELIANSKI (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 23, pp. 970–973*).—The author announced in 1895[1] the isolation of a bacillus capable of fermenting pure cellulose, such as cotton and flax fibers. In the present paper the principal physiological and morphological characteristics of the organism are described.

In order to bring about the fermentation small strips of Swedish filter paper are placed in bottles filled with a suitable culture solution to which a small quantity of slime or soil rich in vegetable material is added. In place of the mineral matter of the culture medium river water may be substituted. Ordinarily fermentation will be shown by the liberation of gas in from 6 to 10 days at 35° C. Examinations of the filter paper in 3 weeks or a month will show an advanced state of decomposition and the presence of colonies of the organism from which pure cultures can be easily made. The organism when young is 4 to 8μ by 0.3 to 0.5μ in diameter. When old, it sometimes attains a length of 12 to 15μ. It is slightly oval or rounded and spore forming. The spores attain a diameter of 1.5μ, resist a temperature of 90° C. for 25 minutes, but are instantly killed at the boiling point. The bacillus in any of its stages of growth is not stained by iodin. It does not grow on gelatin culture media. On gelose it forms small colonies, and while making slight growth on cooked potatoes, it degenerates rapidly.

In the author's experiments filter paper, cotton, and an amorphous precipitated cellulose were placed in a solution containing sulphate of ammonia to which were added 1 per cent peptone and 0.5 per cent asparagin, and the organism introduced. The results of some of the experiments show that from 79 to 96 per cent of the cellulose was destroyed in from 3½ to 5 months. In an extreme case 5 gm. of paper was completely fermented in 3 months. An examination of the residue after washing it with a very weak solution of hydrochloric acid

[1] Compt. Rend. Acad. Sci. Paris, 121 (1895), p. 653.

showed it to be almost wholly made up of spores of the organism, and no color reaction with chlorzinc-iodin was apparent.

The gas fermentation resulted in the liberation of hydrogen and carbon dioxid with no indication of marsh gas.

Volatile acids were produced in considerable quantity, valerianic acid being the most common, but there were no traces of fixed acids.

Some of the higher alcohols were present, but in quantities too small for determination.

Have the common yeasts pathogenic properties? KATHERINE E. GOLDEN (*Proc. Indiana Acad. Sci., 1896, pp. 184–188*).—The author made a study of common yeasts such as are taken into the system through various sources to ascertain whether any of them possess pathogenic properties.

The first series of experiments indicated that yeasts taken into the stomach of rabbits caused neither discomfort nor lesions in any of the organs, even when a fermentable substance was eaten at the same time. The experiments als› indicated that certain yeasts readily pass through the intestinal tract without being killed, although their vigor is somewhat impaired.

A second set of experiments, in which the yeasts were introduced into the circulation, indicated that the common yeasts used possessed no toxic properties for rabbits and guinea pigs. None of them multiplied when introduced into the animal body, and in 4 cases they were destroyed within 48 hours.

A new pigment-forming saprophyte, W. W. RODSEWITSCH (*Vrach [St. Petersburg] (1897), No. 15, p. 436; abst. in Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 21–22, p. 591*).—While examining heads of wheat for *Tilletia levis* the author found quite a number of bacteria, among them *Bacterium megatherium*, *Micrococcus tetragenus*, *M. roseus*, and an undescribed bacillus. The organism is about 0.5 μ long, grows best between 20° and 37° C., and was killed by an exposure of 1 hour to a temperature of 70° C. Subcutaneous injections on guinea pigs showed no pathogenic properties. The bacillus forms an abundant yellow pigment, especially when grown on potatoes or on grape sugar agar for 1 to 2 months, the substratum becoming wholly covered with the yellow pigment. Spore formation was not apparent.

The supposed alcoholic enzym in yeast, J. R. GREEN (*Ann. Bot., 11 (1897), No. 44, pp. 555–562*).—Following the directions of Buchner[1] the author sought to isolate under pressure the enzym reported to exist in yeasts. In the author's experiments the evolution of carbon dioxid and formation of alcohol did not correspond to the change in the specific gravity of the solutions. In one series there was no increase in the quantity of alcohol at the end of the experiment. Considering the evidence of his experiments the author believes that in the yeasts used there was no enzym such as described by Buchner.

Enzymic ferments in plant physiology, F. A. WAUGH (*Science, n. ser., 6 (1897), No. 156, pp. 950–952*).

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[1] Ber. Deut. Chem. Gesell., 30 (1897), p. 117.

Systematic bacteriology, EICHLOFF (*Milch Ztg., 26 (1897), Nos. 51, pp. 809, 810; 52, pp. 828–830; 27 (1898), No. 1, pp. 7, 8*).

A study of the pathogenic bacteria of Cette oysters, A. SABATIER, A. DUCAMP, and J. M. PETIT (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 19, pp. 685–689*).

Diastatic fungi and their utilization, J. TAKAMINE (*Amer. Jour. Pharm., 70 (1898), No. 3, pp. 137–141, figs. 2*).

A simple and accurate method of testing diastatic substances, J. TAKAMINE (*Amer. Jour. Pharm., 70 (1898), No. 3, pp. 141–143*).

Some of the properties of the oxydase of wines, A. BOUFFARD (*Ann. École Nat. Agr. Montpellier, 9 (1895–'96), pp. 213–217*).

Recent researches on the oxydases, G. BERTRAND (*Ann. Agron., 23 (1897), No. 9, pp. 385–399*).

The effect of heating on diastatic ferments, A. PUGLIESE (*Arch. Physiol. [Pflüger], 69, p. 115; abs. in Chem. Ztg., 22 (1898), No. 9, Repert., p. 21*).

The biology of Bacillus baccarinii, L. MACCHIATI (*Bul. Soc. Bot. Ital., 1897, pp. 156–163; abs. in Ztschr. Pflanzenkrank., 7 (1897), No. 6, pp. 354, 355*).—The life history of *Bacillus baccarinii*, the cause of the "mal nero" of grapes is given.

Contribution to the question of the differentiation of Bacillus aerogenes and Bacillus coli communis, J. C. T. SHEFFER (*Arch. Hyg., 30 (1897), No. 4, pp. 291–303, figs. 3*).—As shown by cultural means and agglutination phenomena these bacilli are distinct.

The effect of the so-called monochromic light on bacterial development, BECK and SHULTZ (*Ztschr. Hyg. u. Infektionskrank., 23 (1897), p. 490; abs. in Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 21–22, p. 603*).—Experiments were made with Landolt's color screen to determine the effect of its light on bacteria. Comparisons were made with diffused light and direct light. The monochromic light was found to be without effect on the growth of the bacteria. Röntgen rays were also investigated and found to be without effect on bacteria.

Agar as a medium for the bacteriological examination of water, F. HESS (*Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No. 24–25, pp. 932–937*).—Agar in certain respects it is claimed is superior to gelatin for the bacteriological examination of water and is recommended because it does not liquefy. The medium must contain 1 per cent of agar and the water in the bath in which the agar tubes are placed must be heated to 38 or 40° C. before much water is added to it. Such an amount of water is used as will produce about 200 colonies per plate. To avoid mistakes at least 2 control plates should be made. The plates are to be turned face downward, since in this position they are less likely to dry.

ZOOLOGY.

A revision of the North American bats of the family Vespertilionidæ, G. S. MILLER (*U. S. Dept. Agr., Division of Biological Survey, North American Fauna No. 13, pp. 135, pls. 3, figs. 40*).—This is a purely technical monograph on the North American Vespertilionidæ. After some general questions, such as changes in color of specimens preserved in alcohol, sexual variation, age variation, geographical variation, geographical distribution, migration, measurements, and illustrations are discussed, a lengthy review of the nomenclature of the subject is given, followed by a list of North American bats, comprising 46 species and subspecies recognized as occurring north of Panama and in the West Indies. A detailed systematic description of the various species is given. These fall under the following genera, the numbers denoting the number of species: Antrozous, 2; Euderma, 1; Corynor; hinus, 3; Myotis, 15; Lasionycteris, 1; Pipistrellus, 5; Vespertilio 6-Lasiurus, 6; Dasypterus, 1; Nycticerius, 2; and Rhogeessa, 4.

A comparative table of names used for North American bats is given.

Antagonism between the venom of the Vespidæ and that of the viper—the first a vaccine against the second, C. PHISALIX (*Compt. Rend. Acad. Sci. Paris, 125* (*1897*), *No. 23, pp. 977–979*).—Glycerin extracts of the poison of the bee and the wasp were made by soaking the entire insects in the glycerin and also by treating similarly the poison gland. By the first process other substances were evidently extracted, but it is stated that a comparison of the effects of the extracts obtained in the 2 ways shows that these substances do not affect the results. A poison obtained from the sacs of 5 insects was inoculated into a guinea pig and found to lower the animal's temperature some 4° in 36 hours, and to produce an œdema about the inoculated spot that finally extends over the animal and causes a mortification of the skin. But when 1 to 3 cc. of the glycerin extract was used no appreciable trouble is caused. The œdema disappears quickly. The animal organism, however, undergoes such a change that the future injection of viper venom does not have its usual effect, even if the dose is sufficiently large to kill an uninoculated animal in from 4 to 5 hours.

The duration and intensity of the immunity are found to vary according to the dose of the extract. A guinea pig that had received the poison from the vesicles of 15 insects was perfectly resistant to viper venom at the end of a month. One that had received 2 cc. of the extract was found to be immune for 11 days. In one that had received 1 cc. the immunity became enfeebled toward the fifth day. A smaller dose, ½ cc. was found to be insufficient to produce immunity.

Endeavoring to determine the nature of the immunizing substance, the author heated the venom of the insects to 80°, 100°, and 120° for 20 minutes and found that the immunizing power was not destroyed. The venom was filtered on porcelain and inoculated against a dose of 3½ cc. of viper venom and found not to prevent, though it considerably retarded death. An alcohol extract of the venom was found to produce an œdema and at the same time act as a vaccine against the viper venom. Agitated with chloroform it gives up a large part of its substance. Studies of the chloroform extract showed that the immunizing substance of the insect venom is neither an alkaloid nor an albuminoid. Its nature still remains to be determined.

Passing of the bluebird, C. C. ABBOTT (*Pennsylvania Dept. Agr. Rpt. 1896, pp. 374–376*).—This is a reprint of a newspaper article in which it is shown that the decrease in the number of bluebirds is largely due to the English sparrow.

The common food fishes of Pennsylvania, W. E. MEEHAM (*Pennsylvania Dept. Agr. Rpt. 1896, pp. 569–598, pls. 2*).—The habits, etc., of the shad, herring, whitefish, sunfish, common sunfish (pumpkin-seed, sunny or tobacco box), long-eared sunfish, blue sunfish, strawberry bass, rock bass, black bass, yellow perch, striped bass, pike, catfish, eel, and chub are briefly discussed, and some pieces of fishing apparatus described.

Fish culture in Ontario, G. A. MACCALLUM (*Ontario Dept. Agr. Rpt. 1896, pp. 201–208, figs. 10*).—The fact that farmers may render their land more productive and their families more comfortable by adding fish farming to their customary pursuits is noted. The requirements for carp ponds are briefly stated. Carp should not be raised with other fish, and frogs, turtles, snakes, etc., should be kept out of the pond. The black water beetle (*Hydrophilus piceus*), the yellow banded water beetle (*Dytiscus marginalis*), the dragon fly (*Æschna*), the water flea (*Gammarus pulex*), and the bladder wort (*Utricularia vulgaris*) are noted as fish enemies.

A revision of the American moles, F. W. TRUE (*Proc. U. S. Nat. Mus., 19 (1897), pp. 1–113, pls. 4, figs. 46, maps 4*).

Transplantation experiments with Lumbricidæ, E. JOEST (*Arch. Entwicklungsmech., 5 (1897), pp. 419–569, pls. 2; abs. in Zool. Centbl., 4 (1897), No. 24, pp. 832–836*).—In these studies, in which the morphology and the physiology of the transplantations are discussed, *Lumbricus rubellus* and *Allolobophora terrestris* were employed, mostly young worms without clitellem being used. It was found that 2 bodies of the same individual or of the same species would unite in a relatively short time, but the parts of different species would not unite so readily. The nervous system seems to have a very decided influence over the regeneration of the parts. An interesting fact is noted, that the worms can live for a year without food.

Treatise on concrete zoology. Vol. I, The cell and the protozoa, Y. DELAGE and E. HEROUARD (*Traité de zoologie concrete. Tome I, La Cellule et les protozoaires. Paris: Schleicher Freres, 1896, pp. 584, figs. 870*).—The first of a series of 11 volumes, giving a summary of the animal kingdom. In this volume are discussed the cell and its functions, its structure, chemical composition, physiology, etc. The protozoa are described according to class, order, family, genus, and species.

METEOROLOGY.

Annual summary of meteorological observations in the United States, 1897 (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 25 (1897), No. 13, pp. 569–579, charts 5*).—This number of the Weather Review is devoted to an annual summary of observations on atmospheric pressure, temperature, precipitation, wind movement, cloudiness, and other meteorological phenomena "based essentially upon data received from about 150 regular Weather Bureau stations and 30 regular Canadian stations, all reporting daily by telegraph." The data are given in tables and charts and summarized in the text.

"The lowest annual averages [of temperature] within the United States were: Williston, 38.8°; Moorhead, 39.2°; Bismarck and Duluth, 39.5° each. The highest averages were: Key West, 77.2°; Jupiter, 74.1°; Tampa, 72.2°; Corpus Christi, 70.7°; Galveston, 70.2°.

"The mean annual temperature was above the normal at 101 stations, below at 20, and normal at 12. . . . Maximum temperatures equaling or exceeding 105° occurred at Shreveport, Topeka, Abilene, Phœnix, Yumà, Walla Walla, Redbluff, Sacramento, and Fresno. Minimum temperatures of —25° or lower occurred at Duluth, Moorhead, Bismarck, Williston, Minneapolis, St. Paul, Huron, and Havre.

"The only portions of the country not visited by frost, assuming that frost does not occur with air temperature above 32°, were the southern end of the peninsula of Florida and the coast line of southern California.

"The largest annual ranges of temperature were, as usual, in North Dakota and the northern slope, viz, Havre, 140°; Bismarck, 138°; Williston, 136°, and Moorhead, 129°. The smallest annual ranges were: Key West, 40°; Eureka, 52°, and San Diego, 53°. . . .

"In 1894 precipitation was below average in every district east of the Rocky Mountains. In 1895 there was an excess of precipitation in the southern and middle slopes, but elsewhere between the Rocky Mountains and the Atlantic seaboard there was a marked deficiency. In 1896 there was an excess of rainfall in the extreme Northwest, the upper Mississippi Valley, the Missouri Valley, and the northern and southern slopes. The year 1897 opened with heavy rains in the lower Mississippi Valley, Tennessee, Alabama, and adjoining regions, and it seemed as if the period of diminished rainfall had come to a close. The rainfall of May was about average, except in the Gulf States, Arkansas, Missouri, and upper Mississippi valleys. The June rainfall was generally below the average, but in July unusually heavy rains fell throughout New England, the upper Lake Region, upper Mississippi Valley, Florida, and portions of the Ohio Valley, and the Middle and South Atlantic States. By the middle of August a drought had set in over practically all of the territory east of the Rocky Mountains, which was not broken in some localities until about the 1st of November, and the year ended as one of generally deficient rainfall.

"The stations having the largest deficiencies during 1897 are: Galveston, Texas, 19.44 in.; New Orleans, Louisiana, 17.05 in.; Raleigh, North Carolina, 16.94 in.; Wilmington, North Carolina, 16.66 in. The stations having the largest excesses are: Jupiter, Florida, 29.09 in.; Fort Canby, Washington, 12.88 in.; New Haven, Connecticut, 9.98 in. . . .

"[From] the accumulated departures of the total monthly precipitation from the normal . . . it appears that the total annual precipitation was normal in 1 district, above normal in 6, and below in the remaining 14. As in previous years, the greatest deficiency exists in the west Gulf States and lower Mississippi Valley. Precipitation has been below normal in this region since 1890. The deficit during 1897 has been steadily increasing in the Middle and South Atlantic regions, east and west Gulf, upper and lower Lake, Missouri, and upper Mississippi valleys, but a notable excess has accumulated in the Florida Peninsula. . . .

"The greatest frequencies [of thunderstorms] per station per annum were: South Carolina, 24.9; Florida, 24.3; Missouri and Tennessee, 22.6; North Carolina, 21. The smallest frequencies were: California, 2.6; Washington, 3.9; Oregon, 4.2."

Report of the meteorologist, N. HELME (*Rhode Island Sta. Rpt. 1896, pp. 363–369*).—This includes general remarks on the character of the weather during the year and a tabulated summary of observations on temperature, pressure, precipitation, cloudiness, and prevailing winds during each month of 1896 with a summary for the years 1890 to 1896, inclusive. The summary for 1896 is as follows:

Temperature (degrees F.).—Maximum, 93, May 10; minimum, —11, February 17; mean, 47.7; annual range, 104; highest monthly mean, 70, July; lowest monthly mean, 23.4, January; highest daily mean, 81, May 10; lowest daily mean, —1, January 6. *Air pressure* (inches).—Maximum, 30.61, December; minimum, 28.68, February; mean, 29.84. *Precipitation* (inches).—Total (rain and melted snow), 49.87; greatest monthly, 7.44, September; least monthly, 1.48, April; snow fall—total, 59; greatest monthly, 19, March; least monthly, 5, November. *Weather*.—Number of clear days, 131; number of fair days, 112; number of cloudy days, 123; number of days on which 0.01 in. or more of rain fell, 109.

Report of the meteorologist, T. F. WATSON (*West Virginia Sta. Rpt. 1896, pp. 249–262*).—A tabulated record is given of tri-daily observations during each month of 1896 on temperature, precipitation, direction of wind, and cloudiness. The following is a summary of the principal data: Maximum temperature, 94° F., August 6, 9, 12;

minimum, 0°, January 5, February 19, 21, 22; mean, 54°; total precipitation, 44.57 in.; melted snow, 7.04 in.; prevailing direction of wind, west.

Weather record for 1896 at Newport, Arkansas (*Arkansas Sta. Rpt. 1897, p. 100*).—Reprinted from Bulletin 46 of the station (E. S. R., 9, p. 630).

WATER—SOILS.

Soil moisture, G. H. FAILYER and J. T. WILLARD (*Kansas Sta. Bul. 68, pp. 75–101, dgms. 9*).—This is an account of observations on the moisture content of different kinds of soil treated in different ways at the station and at Garden City and Oakley, Kansas, during the summers of 1895 and 1896. Daily determinations of moisture were made in plowed ground and sod at Garden City from June to September, 1895, and at Oakley during June and July, 1896. At both Garden City and Oakley, the moisture content of plats which had been subsoiled and of those which had not been subsoiled was determined. The effect of salt and gypsum (at rates of 450 and 900 lbs. per acre) on the moisture content of the soil was also tested at Garden City. The experiments at the station included observations in the field on untreated plats and plats treated as follows: (1) Cultivated to a depth of about 5 in. with a hoe; (2) mulched with green grass and sorghum bagasse to a depth of 3 or 4 in.; (3) surface raked to a fine condition to a depth of an inch or more; (4) sown thickly to sorghum broadcast; and observations on evaporation from soils in galvanized iron pails $10\frac{1}{2}$ in. in diameter at the top and $9\frac{1}{4}$ in. deep. The soils were treated as follows:

"Pots 1, 2, 3, and 4 contained the soil unmixed with other substances. No. 1 was not treated in any way; No. 2 had the soil surface finely pulverized; No. 3 had the soil surface coarsely pulverized; No. 4 was mulched. Pots 5, 6, 7, 8, and 9 were like No. 1, except that No. 5 contained 1 per cent of lime; No. 6, 1 per cent of gypsum; No. 7, one-hundredth of 1 per cent of common salt; No. 8, one-hundredth of 1 per cent of magnesium chlorid; No. 9, 50 per cent of sand.

"In addition to the above pots, we had one numbered 13 which contained soil as in No. 1, but was supplied with water at the bottom by means of a cistern inclosing the bottom of the pail. This cistern was soldered to the pail, could be filled by means of a hole which was closed by a rubber stopper, and communicated with the bottom of the soil through numerous holes over which lay a sheet of blotting paper. The object of this experiment was to observe the rate of evaporation from a soil kept wet by a continuous water supply. Later we added still another, No. 15, which was like No. 9, that is, half sand and half soil, except that it had the continuous water supply as described above. The object in this case was to test further the rate of evaporation from a sandy soil compared with one much less sandy.

"The loss of water was determined by weighing the pots with their contents daily, thus obviating the error that must be inherent to a less or greater degree in any method of field sampling."

The results of the experiments are given in tables and diagrams. The principal results are summarized as follows:

"In these trials, the undisturbed prairie sod, as compared with that which had been brought under cultivation, was much drier in all cases, except following a heavy rain. In this case, the part sampled of the sod, the upper portion, was about as wet as the plowed ground, but it rapidly dried out again. The plowed ground, not cropped nor cultivated during the season, was more uniform in its water content than the sod, and was persistently in better condition."

There was no essential difference at the close of the season in the moisture content of a soil which in the previous spring had been (1) plowed shallow, (2) plowed deep, or (3) subsoiled. The results of the tests of the effect of salt and gypsum on moisture content were inconclusive. In a comparison of the loss of water from untreated soil and that cultivated but not cropped, mulched but not cropped, or cropped but not cultivated, the cropped soil dried out most rapidly, the next in order in this respect being the untreated soil. Surface cultivation to a depth of 4 or 5 in. was about as effective in conserving the moisture as the mulch.

"Experiments with soil in galvanized-iron pots, under well-controlled conditions, showed that a layer of finely pulverized soil $\frac{3}{4}$ in. thick had no marked influence on the rate of evaporation; that a hay mulch 2 in. thick checks evaporation most effectively, but that evaporation proceeds at so rapid a rate from bare soil that a mulch, to be most useful, must be promptly applied; that the rate of evaporation from a sandy soil is less than that from one less sandy when both are kept constantly wet, but if allowed to dry, the sandy soil becomes much drier; that neither salt, gypsum, lime, nor magnesium chlorid exerts any beneficial effect in checking evaporation from the soil, the evaporation being practically the same as from untreated soil."

Contribution to the study of nitrification in the soil, T. SCHLOESING, Jr. (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 21, pp. 824–827*).—It is stated that nitrification and microbic combustion in general are less active in fine-grained, compact soils than in lighter, coarse-grained soils. This is generally attributed to the greater facility with which the air circulates in the lighter soils and supplies the necessary oxygen.

The author shows that in many cases it is not air but available water which is deficient in the heavy soils.[1] As is well known, the fine particles of heavy soils have so strong an attraction for water that a large part of the soil moisture is rendered unavailable for the growth of the higher plants. It appears from these experiments that it is also rendered unavailable for the use of the nitric ferment. In order that nitrification may be equally active in light and in heavy soils, the latter must have a higher percentage of moisture than the former.

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[1] See also Dehérain, Compt. Rend. Acad. Sci. Paris, 121 (1895), pp. 30–35.

This fact is brought out in the following results of experiments with artificial soils:

Nitrification in artificial soils of different composition and water content.

	Composition of the soil.				Sulphate of ammonia added = nitric nitrogen.	Nitric nitrogen at end of experiment.	Percentage nitrified.
	Sand.	Clay.	Chalk.	Water.			
First series, Jan. 14 to Mar. 27, temperature 26°–27° C.	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Mg.*	*Mg.*	*Per cent.*
Soil No. 1	100	0	0.5	10	40.9	34.1	83
Soil No. 2	90	10	.5	10	40.9	38.5	94
Soil No. 3	80	20	.5	10	40.9	36.2	89
Soil No. 4	75	25	.5	10	40.9	23.5	56
Soil No. 5	70	30	.5	10	40.9	4.23	10
Second series, July 17 to Nov. 1, temperature of laboratory.							
Soil No. 6	100	0	1	9.5	81.8	51.2	63
Soil No. 7	90	10	1	9.5	81.8	54.1	66
Soil No. 8	85	15	1	9.5	81.8	77.1	94
Soil No. 9	80	20	1	9.5	81.8	81.9	100
Soil No. 10	75	25	1	9.5	81.8	17	21
Soil No. 11	70	30	1	9.5	81.8	2.2	2.7
Third series, April 1 to June 12, temperature 26° C.							
Soil No. 12	70	30	.5	10.6	54.5	43.6	80
Soil No. 13	70	30	.5	11.5	54.5	55.9	100

It will be observed that in case of soil No. 11, in which the nitrification was lowest (2.7 per cent), it was only necessary to increase the water content from 9.5 gm. to 11.5 to render nitrification complete. It is evident that it was not air but water which was deficient in the soils containing 25 per cent or more of clay. A very slight increase of water was sufficient to convert almost absolute inactivity into complete nitrification.

Influence of light, humidity of soil, and depth of cultivation on the position of the stooling node of winter rye, D. N. PRYANISHNIKOV and E. BOARLYUK (*Izv. Moscow Selskokhoz. Inst., 3 (1897), II, pp. 47–49*).—The experiments were made in 18 cylindrical glass vessels filled with field soil. One half of the vessels had full illumination, while the other half was shaded. Three degrees of humidity were maintained, 30, 55, and 80 per cent of the maximum water capacity of the soil, and the depth of cultivation was about 0.8, 2, and 3 in. In each vessel 10 grains of rye were planted. The results obtained led to the following conclusions: The deeper the grain is seeded the deeper the stooling node, but not in the same degree, since the lowering of the node does not keep pace with the increase of depth of the seed. Shading brings the stooling node nearer to the surface.

These two conclusions relate to the first stooling node. The tendency to form a second node increases with the depth of planting. The position of this second node is strongly influenced by the conditions of illumination, but not by the depth of planting. In regard to the influence of the humidity of the soil no definite conclusions can be drawn.—P. FIREMAN.

A study of methods of cultivation, J. H. SHEPPERD and J. A. JEFFERY (*North Dakota Sta. Bul. 29, pp. 185–206*).—An account is given of one year's experiments on 52 quarter-acre and 8 fifth-acre plats at the station to test the relative merits of deep and shallow and fall and spring plowing, subsoiling to different depths, subsurface packing, harrowing after plowing, disking, and the ordinary and Campbell methods of cultivation.

The Campbell method of cultivation is described as follows:

"(1) Plow deeply—7 or 8 in.—preceding the plow with a disk harrow to mellow the surface about to be turned under.

"(2) Follow the plow within a few hours with the Campbell subsurface packer. This machine consists essentially of a series of cast-iron wheels placed abreast upon an iron axle, so that their rims, which are about an inch thick at the base, narrowing to a sharp angle at the extreme circumference, are about 5 in. apart. The whole machine, when run over the soil, is heavily loaded. The object of the subsurface packer is, first, to further pulverize the soil, and second, to bring the newly turned soil, which is held up to a greater or less extent by the stubble, into contact with the bottom of the furrow. This packing of the furrow slice upon the bottom of the furrow renews the capillary relation between the newly turned soil and that below, a thing desirable in a dry fall, and also opens a way downward for rain, should there be any. It is well known that water does not percolate so readily into a soil that is dry and filled with air spaces as it does into one that is already moist, and, while mellow, is not filled with large openings.

"(3) Follow the subsurface packer with a light peg-tooth harrow and harrow the land at intervals thereafter until the crop is sown. This is to keep a shallow mulch over the surface of the ground to retard the evaporation of the moisture into the air.

"(4) Put in all crops so that they may be cultivated. Grains are sown in drills 16 to 24 in. apart.

"(5) Cultivate shallow and often. The Campbell grain drill can be converted into a spring-tooth cultivator, which cultivates the same number of rows that the drill sows. Mr. Campbell's theory is (*a*) that by this cultivation the loss of moisture into the air is lessened, and (*b*) that a fewer number of plants with all the moisture they may need will produce a greater yield than more plants with an insufficient supply of moisture."

Moisture determinations were made by King's method[1] in samples of soil from most of the plats May 24 and August 19 and 20, and from a few of them June 6, and the results with data for cost of production and yields are given in tables.

"In drawing conclusions as to the relative merits of the methods employed in these experiments, it must be remembered that the present year has been one of very unusual conditions, and that future results, under conditions usually prevailing, may be very different from those recorded in this bulletin. Bearing these facts in mind, observe:

"(1) On ground fall-plowed with ordinary plow, (*a*) the largest average yield was from ground subsoiled 8 in. below a 6-in. furrow. (*b*) This yield was practically equaled by the average yield from plats packed by Campbell's subsurface packer and cropped in the ordinary way. (*c*) The highest yields from single plats were from plats subsoiled 8 in. below the bottom of a 6-in. furrow. These were followed

[1] Wisconsin Sta. Rpt. 1890, p. 160 (E. S. R., 2, p. 445).

closely by a plat which was subsurface packed. (*d*) The sowing of wheat in drills on ground prepared either by the Campbell or by the ordinary method, and cultivated, has not proved a success under prevailing conditions. It has failed to give profitable yields. (*e*) As between deep and shallow plowing, there stands a slight difference in average results in favor of shallow plowing. (*f*) The yield of plats 7 and 20 would seem to indicate virtue in fall harrowing.

"(2) The plats plowed and subsoiled with the disk plow leads all other plats with a yield of 26.53 bu. per acre. This was followed closely by the plat which was plowed with a disk plow but not subsoiled.

"(3) On spring-plowed plats, (*a*) the plats that gave the largest average yield (20.36 bu.) were those which were subsurface packed and sown in the ordinary way. (*b*) The next best yield came from the plat which was plowed with the disk plow and subsurface packed and sown in the ordinary way. (*c*) The sowing of wheat in drills, on ground prepared either by the Campbell or other methods, and cultivated, has not given good results. (*d*) Here, as on the fall-plowed ground, a slight increase of yield was realized on shallow plowing over that on deep plowing.

"(4) Comparing results on fall plowing with those on spring plowing, it will be seen for this year that (*a*) the subsurface packing of ground immediately after plowing seems to have a very beneficial effect upon yields in both cases; (*b*) fall subsoiling with a subsoiler to a depth of 8 in. below the bottom of a 6-in. furrow has a beneficial effect upon the next following crop, while spring subsoiling with a subsoiler gave lower yields in the next crop than when the ground was prepared in the ordinary way; (*c*) fall subsoiling with the disk plow, when followed by the harrow, gave an increased yield, while spring subsoiling with a disk plow lessened the yield; (*d*) the average yield from shallow plowing, both spring and fall, is slightly larger than that from deep plowing; (*e*) sowing in drills and cultivating has given reduced yields in every case."

Experiments similar to the above were made in cooperation with the Great Northern Railroad Company at 3 other places in North Dakota, viz, at Lisbon, and 6 miles south of Glen Ullin and 8 miles north of Jamestown, and observations were made at a number of other farms where the Campbell method was being tested under the auspices of the Railroad Company.

The conditions were so different in different cases that definite conclusions are not attempted, but the statement is made that—

"East of the Missouri River, where the weather conditions have been similar to those experienced on the station farm, the results as to yields, so far as reported, have been similar to those obtained at the station. The yield of Campbell-grown grains have been less than those of ordinary grown grain.

"In nearly every case where moisture determinations have been made more moisture was found in the Campbell-worked ground than in that worked by the ordinary method."

Geological history of the Chautauqua grape belt, R. S. TARR (*New York Cornell Sta. Rpt. 1896, pp. 127–158, figs. 25*).—A reprint of Bulletin 109 of the station (E. S. R., 8, p. 111).

The moisture of the soil and its conservation, L. A. CLINTON (*New York Cornell Sta. Rpt. 1896, pp. 477–498, figs. 12*).—A reprint of Bulletin 120 of the station (E. S. R., 8, p. 477).

The texture of the soil, L. H. BAILEY (*New York Cornell Sta. Rpt. 1896, pp. 467–473, figs. 3*).—A reprint of Bulletin 119 of the station (E. S. R., 8, p. 476).

Removal of the fertile soil from the farm by water, J. T. ROTHROCK (*Pennsylvania Dept. Agr. Rpt. 1896, pp. 396–405, pl. 1*).—A popular discussion of the fertilizing value of the material removed from soil by surface washing and the means of preventing loss from this source. "The two sovereign remedies against washing on the farm are, first, a dense, well-matted sward, which should be kept in good condition by frequent top-dressing; or if this fails, a prompt restoration of land rendered unproductive to a forest condition."

Soil improvement, R. L. BENNETT (*Arkansas Sta. Rpt. 1897, pp. 79–99, fig. 1*).—Reprinted from Bulletin 46 of the station (E. S. R., 9, p. 634).

The bacteria of the soil, with special reference to soil inoculation, R. S. MACDOUGALL (*Trans. Bot. Soc. Edinburgh, 21 (1897), pp. 25–40*).

The Cunrau estate and the Rimpau system of marsh culture, U. SVERDRUP (*Tidsskr. Norske Landbr., 4 (1897), pp. 400–426*).

FERTILIZERS.

Denitrification and farmyard manure, R. WARINGTON (*Jour. Roy. Agr. Soc. England, 3. ser., 8 (1897), pt. IV, pp. 577–607*).—The author takes exceptions to the conclusions of German investigators (E. S. R., 8, pp. 761, 873) regarding denitrification as due to the action of manure in the soil. He maintains that the denitrifying organisms present in manure, straw, litter, etc., are derived originally from atmospheric dust. Of the conditions necessary to their activity "the supply of organic matter is by far the most important." Figures from Wagner's and Maercker's experiments are quoted to show that the variations in the extent of denitrification in different cases may be explained by variations in the amounts of assimilable organic matter supplied in the manures.[1] Attention is called to the fact, already noted by Dehérain (E. S. R., 8, p. 870), that the amount of manure used in these experiments was far in excess of that ordinarily applied in practice and the results obtained, therefore, furnish "no proof that the same actions will occur to the same extent in ordinary arable farming." This statement is borne out by the results of the Rothamsted field experiments with manure, which are quoted and discussed.

"One fact which comes into great prominence in the German experiments is that ordinary farmyard manure is valueless as food for plants until it is nitrified; this is surely the only conclusion we can draw from the want of action of the manure when applied in large quantities in the pot experiments. In the light of these results the economy of large dressings of farmyard manure becomes very questionable."

On the substitution of soda for, and its value in connection with, potash, H. J. WHEELER and G. M. TUCKER (*Rhode Island Sta. Rpt. 1896, pp. 221–241, pls. 4, dgms. 10*).—This is a continuation of investigations carried on since 1894 (E. S. R., 8, p. 579). During the first 2 years of the experiment 2 classes of plants were selected: (1) Those which had given indications that they might be benefited by soda and (2) those which it was thought would not be benefited by it.

"[In 1896, however, it was decided to] conduct the experiments in such a way as to exhaust the assimilable potash from the soil as rapidly as possible in order that any differences which might be attributable to the use of soda might become more strikingly manifest. In order to accomplish this it was planned to grow, if possi-

[1] See also Stutzer, Deut. Landw. Presse, 24 (1897), p. 665 (E. S. R., 9, p. 635).

ble, 2 crops per year upon this land until some marked indications of a deficiency of potash might show themselves by those plants which received soda without any addition of potash. . . . In accordance with this plan the 2 crops selected for 1896 were oats and millet, the oats being sown as early as possible and cut while in the milk, so as to enable the millet to enjoy as long a period of growth as possible. . . .

"Dried blood was employed at the rate of 1,020 lbs. per acre or 17 lbs. per plat, dissolved boneblack at the rate of 600 lbs. per acre or 10 lbs. per plat, and finely ground phosphate rock (floats) at the rate of 480 lbs. per acre or 8 lbs. per plat. Each plat received, likewise, magnesium sulphate (Epsom salts) at the rate of 420 lbs. per acre or 7 lbs. per plat. Those plats which received lime in 1894 were again limed in 1896 at the rate of 1,200 lbs. per acre of air-slacked lime or 20 lbs. per plat. Full, three-quarters, half, and quarter rations of the potassium and sodium salts were employed in a similar manner as in the 2 preceding years, the full rations in 1896 being as follows: Potassium carbonate, 360 lbs. per acre, equal to 6 lbs. per plat; sodium carbonate, 240.6 lbs. per acre, equal to 4.01 lbs. per plat; muriate of potash, 394.4 lbs. per acre, equal to 6.64 lbs. per plat; sodium chlorid, 274.2 lbs. per acre, equal to 4.57 lbs. per plat."

Results of the different systems of fertilizing are shown for both crops in tables and diagrams. The results are summarized as follows:

"The inferiority of soda in the absence of potash, as compared with potash in the absence of soda, has become more strikingly manifest from year to year, in each of the 3 years of the experiment. Prior to 1896 the yields were frequently increased by the addition of potash to the full soda ration, and less frequently, if at all, with the addition of soda to the full potash ration. This season, however, in connection with the second crop (millet), the addition of increasing quantities of potash to the full soda ration has increased the crop, in the order of the increased application of potash in each instance. Soda added to the potash ration has this year for the first time given indications of probable usefulness, which, if not incidental, can only become strikingly manifest, if at all, as the depletion of the assimilable potash on the soda plats increases. It would be too hasty to conclude definitely from this year's results that an addition of soda to the potash ration had been positively beneficial, and it may be sufficient at this time to state merely that the results are strongly indicative that such may be the case, a point which it is hoped may be determined in future years."

The results of a comparison on barley and clover of nitrate of potash and of muriate of potash, combined with nitrate of soda, are briefly discussed in this connection. The results of this experiment were not conclusive as to the beneficial or injurious effect of the soda and chlorin upon the plats where muriate of potash and nitrate of soda were used.

Analyses and valuations of fertilizers, L. A. VOORHEES and J. P. STREET (*New Jersey Stas. Bul. 124, pp. 48*).—This bulletin gives the trade values of fertilizing constituents in 1897 and the results of examinations of the standard materials supplying them, as well as of home mixtures, factory-mixed fertilizers, and miscellaneous fertilizing substances. Analyses and valuations are given of 75 samples of standard raw materials, 285 samples of brands of complete fertilizers, 16 brands of home and special mixtures, 35 of ground bone, and 36 of miscellaneous products; the materials examined include, in addition to the mixed fertilizers, nitrate of soda, sulphate of ammonia, dried blood, dry ground fish, bone, tankage, dissolved boneblack, dissolved rock phosphates, muriate and sulphate of potash, kainit, double sulphate of potash and magnesium, marl, garbage fertilizer, mussels, screenings, wool combings, wood ashes, granulated tobacco and sulphur, and tobacco stems.

A study of the results reported will show that—

"while varying considerably in price, nitrate of soda, sulphate of ammonia, and the potash salts are quite uniform in their composition, and comparatively safe to purchase without special chemical examination, although, of course, they should be accompanied by a guarantee. The organic materials, such as dried blood, dried and ground fish, tankage and ground bone, are always more or less variable, and are best purchased with special reference to a guarantee. In a majority of these cases this has been done and the amounts of plant food guaranteed have been delivered to the consumer. The samples of South Carolina rock superphosphate or acid phosphate contain available phosphoric acid in amounts varying from 12.05 per cent to 16.73 per cent, without any decided relation between content and price. To avoid this uncertainty a system of purchase, in which only the amounts actually delivered are paid for, is recommended."

The results show an improvement in 1897 over previous years in the matter of conforming to guarantees. Eighty per cent of the brands examined contained as much total plant food as guaranteed, 68 per cent reaching or exceeding their guarantees in all particulars, and 40 per cent of the remainder having their deficiencies counterbalanced by an excess in other respects.

The average composition, estimated value, and selling price of all brands of complete fertilizers examined during the year (E. S. R., 8, p. 966) are as follows: Total nitrogen, 2.54 per cent; total phosphoric acid, 10.93 per cent; available phosphoric acid, 8.01 per cent; insoluble phosphoric acid, 2.91 per cent; potash, 5.01 per cent; station valuation, $21.58; selling price, $29.28; actual difference, $7.70; percentage difference, 35.7.

Analyses of 7 samples of home-mixed fertilizers and 9 samples of fertilizers mixed by regular manufacturers specially for their patrons are reported.

"[The results show] that the mixtures were, on the whole, of the composition intended, with the advantage on the side of the manufacturers' mixtures. Many of the guarantees, however, are based upon an estimated analysis of the raw materials. The home mixtures, on the average, cost $4.38 less, and the manufacturers' mixtures $0.38 less than their valuation, a difference of $4, which represents the expenses of mixing, rebagging, etc. In either case there is a decided saving over buying the average fertilizer in the average way, since the selling price of the average complete fertilizer is $7.70 more than its valuation."

Further observations on the growth of various plants upon an acid upland soil, limed and unlimed, H. J. WHEELER (*Rhode Island Sta. Rpt. 1896, pp. 242–272, pls. 8*).—An account is given of a continuation during 1896 of experiments commenced in 1893 (E. S. R., 8, p. 580). The system of fertilizing has been fully described in previous reports, the same method of fertilizing being used in 1896 as in previous years. No lime has been applied since 1894. The plants experimented with in 1896 included grasses (11 species), blue lupines, crimson clover, barley, beets, carrots, dandelion, rye, spinach, gladiolus, and various small fruits, orchard fruits, and trees.

"The experiments with grasses show that they vary almost as widely as other plants, so far as concerns the effect of lime upon them. Of the grasses tested, Kentucky blue grass and timothy seem to be most benefited by liming, and Rhode Island bent and redtop most indifferent to it. Awnless brome grass, meadow oat grass, tall fescue and orchard grass, which are among the most promising of the other grasses tried, all show decided benefit from liming. These results serve to explain why on many of our Rhode Island soils timothy runs out quickly, and redtop and Rhode Island bent persist better. . . .

"The watermelon seems thus far to be about the only plant frequently grown here which may not be benefited eventually by liming. It is hoped, however, in succeeding years to test this plant more fully.

"Potatoes have sometimes produced a slightly greater total yield from liming and usually a much greater percentage of merchantable tubers, but [lime in the form of] wood ashes and water or air-slacked lime (not gypsum or land plaster) increases the virulence of the potato scab to a serious degree. . . .

"Since potatoes, Indian corn, rye, Rhode Island bent grass, and redtop are less in need of lime than timothy, clover, barley, etc., certain fields could be set aside for rotations without lime and others with it.

"Beets have shown a wonderful benefit from liming, not only on the station farm, but in many other sections of the State where experiments with them have been tried.

"Spinach has again shown great benefit from liming, it being in this particular like lettuce.

"Rye, dandelions (excepting the first crop in the spring), carrots, and crimson clover have shown a less marked benefit from liming than beets and spinach.

"Lupines . . . are seriously injured by liming.

"In regard to small fruits, orchard fruits, and forest trees little can be said at this time, except that grapes (particularly the Delaware), peach, and elm trees, and quince bushes seem to be benefited by liming. Blackberries were apparently very thrifty on the unlimed sulphate of ammonia plat, where many plants are wholly unable to endure the soil conditions."

A description of the formalin and corrosive-sublimate treatments for potato scab is added.

Continued observations for the purpose of determining in how far the results secured in a soil test with a given plant are applicable to others, H. J. WHEELER and G. M. TUCKER (*Rhode Island Sta. Rpt. 1896, pp. 273–278*).—In previous experiments (E. S. R., 8, p. 571) a majority of the crops experimented with indicated a greater deficiency of phosphoric acid than of potash in the soil, while 3 plants, white bean, sunflower, and summer squash, indicated that potash was more deficient than phosphoric acid.

"In order to further test this question the experiment was continued in 1896 with the sunflower, white bean, and crimson clover, and the following crops which had heretofore invariably shown a deficiency of phosphoric acid, namely, Indian corn, millet, and spring rye.

"The results of the experiment this season with the sunflower indicate that the soil was chiefly deficient in phosphoric acid, followed by potash and nitrogen, respectively, or, in other words, was practically in accord with results secured with other plants in previous years. Crimson clover from this year's indications, as well as from those of the 2 previous years, does not seem to be so well adapted as many other plants for determining the soil requirements, so far as concerns phosphoric acid. The results of the 3 years indicate that out of the 35 plants employed in this soil test (excepting, possibly, crimson clover, white beans, sunflowers, and squashes), almost any one of them would have answered in a satisfactory manner the question as to what element was chiefly deficient in this soil."

Observations for the purpose of ascertaining if a lack of lime is more or less general in Rhode Island soils, C. O. FLAGG, H. J. WHEELER, and G. E. ADAMS (*Rhode Island Sta. Rpt. 1896, pp. 282–293, pls. 6*).—This is a continuation of experiments of previous years (E. S. R., 8, p. 580). The effect of lime in connection with other fertilizing materials was tested on barley and beets growing on acid upland soils at 11 different places in Rhode Island.

"The results with barley have shown in a number of instances a benefit from lime, even when it was applied in considerable quantity directly before the sowing of the grain. In 4 instances where the barley was not benefited, it seems probable that such would have been the case had the lime been applied a year before, or had the quantity been much less. In the experiment with beets they were benefited decidedly by liming, in every case but one, the least gain obtained having been 21 per cent, while in other cases the crop was increased 6, 9, 26, and in one case even 100 times." . . .

Further observations for the purpose of determining whether the beneficial action of lime upon the soil of the experiment station farm is due to any extent to its neutralizing action, H. J. WHEELER, G. M. TUCKER, and B. L. HARTWELL (*Rhode Island Sta. Rpt. 1896, pp. 294–318, pls. 4*).—An account is given of 5 series of experiments with barley (4) and potatoes (1) grown in pots 18 in. in diameter and 26 in. deep and of 1 series of experiments with barley and clover on field plats. In all experiments phosphoric acid, potash, and nitrogen were supplied in sufficient amounts to meet the requirements of the crops grown, and in different cases caustic lime and magnesia, potassium and sodium carbonates, and wood ashes were used in amounts which insured the same neutralizing effect. Parallel experiments with calcium carbonate and sulphate were also made. The results are tabulated, discussed, and summarized as follows:

"When treated alike in other respects an ill effect from continuous applications of sulphate of ammonia upon the experiment station soil was found to result eventually in all cases, while this was not the case where an equivalent amount of nitrogen in the form of nitrate of soda was employed. The ill effect of sulphate of ammonia can be prevented altogether by the employment in connection with it of sufficient potassium carbonate in place of crude potassium chlorid (muriate of potash) or by the employment of wood ashes, air-slacked lime, sodium carbonate (soda ash), or caustic magnesia. Magnesium sulphate (Epsom salts) was not found equal in this respect to caustic magnesia; the same was true in a more marked degree of calcium sulphate (gypsum or land plaster) as compared with air-slacked lime. Calcium sulphate failed to exert the same beneficial influence upon the growth of potatoes as calcium carbonate, wood ashes, air-slacked lime, calcium acetate, and calcium oxalate; all of which latter substances, if not already composed of or containing calcium carbonate, are changed into that form within the soil.

"These observations lead to the conclusion that aside from a beneficial, manurial, or physical influence which air-slacked lime, wood ashes, calcium carbonate, potassium carbonate, sodium carbonate, and caustic magnesia may have had, they were probably useful, in a high degree, on account of a natural deficiency of bases in the soil, and their ability to correct acidity (sourness) naturally existing or induced therein by artificial methods of cropping and manuring."

Trial of phosphates, C. O. FLAGG and G. M. TUCKER (*Rhode Island Sta. Rpt. 1896, pp. 327–343, pl. 1*).—

"The plan of this experiment, commenced in 1894 [E. S. R., 7, p. 851], is to apply the same money value of various materials used to supply phosphoric acid, together with a suitable and like quantity of nitrate of soda and muriate of potash, to 2 series of 10 plats each (including 1 check plat without phosphoric acid), one series limed at the rate of 1 ton per acre at the beginning of the experiment, and the other series unlimed. . . .

"In the fall of 1895, when the plats were seeded to grass, a full ration of the insoluble phosphates—fine ground bone, slag meal, floats, raw alumina phosphate, and ignited alumina phosphate—was applied. [None of] the soluble phosphates—dissolved boneblack, dissolved bone, dissolved phosphate rock (often called acid phosphate) and double superphosphate—were used at time of seeding, but one-third of a full ration was applied each of 3 successive springtimes as a top-dressing. A one-third ration of nitrate of soda and muriate of potash was applied to all the plats. . . .

"The grass in the spring of 1896 showed a much deeper green color throughout the limed series and in the unlimed plats which had received fine ground bone, slag meal, and floats presented the best appearance. The phosphates above named gave the best catch in both series, while dissolved boneblack, dissolved bone, and dissolved phosphate rock were next in rank, giving a fair to good catch in connection with lime, but a very poor one without it. Double superphosphate gave a fair catch with lime and without it a failure. The raw and ignited alumina phosphates and the plat with no phosphoric acid gave the poorest catch in the limed series and without lime a practical failure.

"It is manifestly unfair to judge the efficiency of the various phosphates at this time, because only 3 years have elapsed since the experiment was begun, but especially because the soluble phosphates will not be upon an equal footing with the insoluble until 2 more annual top-dressings have been applied. Judging from the crops produced thus far, they appear to stand in the following order: Fine ground bone, slag meal, floats, dissolved boneblack, dissolved phosphate rock (3 last named about equal), dissolved bone, double superphosphate, ignited alumina phosphate, and raw alumina phosphate, the latter failing to produce as good a crop as the check plat, without phosphoric acid.

"The application of 1 ton of air-slacked lime per acre at the beginning of the experiment in connection with the phosphates has produced a marked beneficial effect, as seen in the general color, growth, and appearance of the crops. The yields have been greater from the limed series than from the unlimed with all the crops grown since the installation of the experiment, the increase due to liming being as follows: Corn crop of 1894 (9 plats), 669.3 lbs. stover, 460.9 lbs. hard corn, and 43.8 lbs. soft corn; oat crop of 1885 (10 plats), 20.25 lbs. of grain and 813.5 lbs. of straw; hay crop of 1896 (10 plats), 1,593 lbs."

Concerning fertilizers and manures, G. L. TELLER (*Arkansas Sta. Rpt. 1897, pp. 101–118*).—A reprint of Bulletin 47 of the station (E. S. R., 9, p. 740).

Fertilizer analyses, R. C. KEDZIE (*Michigan Sta. Bul. 145, pp. 23*).—This bulletin reports analyses of 55 samples of fertilizers examined during 1897, with a schedule of trade values of fertilizing ingredients and a popular discussion of the subject of fertilizers under the following heads: Commercial fertilizers a modern product, names of fertilizers, what do commercial fertilizers contain, results of soil analyses, leading kinds of fertilizers, lime, shall the farmer use commercial fertilizers, are fertilizers stimulants, and how and why are they beneficial, how commercial fertilizers are collected and analyzed, and terms used in reporting fertilizer analyses.

Analyses of commercial fertilizers and other manurial substances, C. A. GOESSMANN (*Massachusetts Hatch Sta. Bul. 49, pp. 24*).—Analyses are reported in tabular form of 259 samples of fertilizing materials, including wood ashes, sulphate and muriate of potash, cotton-seed meal, nitrate of soda, sulphate of ammonia, tankage, dry ground fish, ground bone, acid phosphate, South Carolina rock phosphate, mixed fertilizers, cotton waste, hop refuse, spent brewers' grains, sheep manure, muck, compost, soil, and loam.

Composition of commercial fertilizers, H. B. MCDONNELL ET AL. (*Maryland Sta. Bul. 49, pp. 105–160*).—This bulletin gives a schedule of trade values of fertilizing materials, a list of fertilizers licensed for sale in Maryland for the year ending February 1, 1898, and tabulated analyses and valuations of 390 samples of fertilizers examined during the period from February to July, 1897.

Commercial fertilizers, B. H. HITE (*West Virginia Sta. Rpt. 1896, pp. 30–50*).—Analyses and valuations of 478 samples of fertilizing materials are reported.

How to conduct field experiments with fertilizers, G. C. CALDWELL (*New York Cornell Sta. Rpt. 1897, pp. 139–147*).—A reprint of Bulletin 129 of the station (E. S. R., 9, p. 339).

Experiments with artificial fertilizers (*Ugeskr. Landm., 42 (1897), No. 39, pp. 514–524*).

Further observations upon the growth of barley upon an acid upland soil, limed and unlimed, H. J. WHEELER and G. M. TUCKER (*Rhode Island Sta. Rpt. 1896, pp. 279–281*).—Observations upon limed and unlimed acid soil agree with those of previous years (E. S. R., 8, p. 580) and indicate that "on a decidedly acid soil barley may be wonderfully benefited by liming."

FIELD CROPS.

Investigations on the influence of factors of growth on the productive capacity of cultivated plants, E. WOLLNY (*Forsch. Agr. Phys.* [*Wollny*], *20* (*1897*), *No. 1, pp. 53–110, fig. 1*).—A study of the influence of moisture, plant food, and light was made and the results are here reported in tabular form and discussed in detail. Discussions on the influence of temperature and electricity are based upon experiments made by other investigators.

It was found that, in general, grain and root crops reached their highest productive capacity with a smaller percentage of moisture in the soil than legumes and grasses did. The optimum moisture content of the soil for grains and root crops is shown to be from 40 to 60 per cent of the amount of moisture the soil is capable of holding. For legumes the optimum varied between 50 and 70 per cent of that amount and for meadow plants between 60 and 80 per cent.

Experiments were made with different amounts of fertilizer mixtures supplying the necessary elements of plant food in a readily available form to ascertain the influence on plant growth. Rye, peas, rape, sugar beets, potatoes, beans, and corn were grown in pots on sandy, loamy, and peaty soils to which these fertilizer mixtures were applied in quantities differing by a definite amount. The results showed that an increase in plant food does not produce a proportional increase in yield. The author concludes that the increase of fertilizing material is only profitable within certain limits, and that finally an optimum application is reached which results in a maximum production of plant substance. Beyond this a further increase of available plant food material becomes detrimental to plant growth, due, it is stated, to too great amounts of fertilizing material being carried in solution in the soil moisture, which retard the osmotic action of the roots, thus depriving the plant of its necessary supply of moisture and in consequence causing the turgescence of the cell to decline and in extreme cases to disappear. It was observed that with an increased amount of moisture in the soil larger amounts of the fertilizer mixtures were necessary to retard the growth of the plants.

A study of the influence of light in different degrees of intensity, designated as strong, medium, and weak light, was made; and similar experiments of other investigators are cited in connection with the reported results. It is shown that the productive capacity of cultivated plants both in quantity and quality is dependent upon the intensity of light. In every case plants grown in a strong light were the most productive. The results of experiments made by Briem and Pagnoul are tabulated to show the effect of light on beets and potatoes. Beets grown in the light contained more sugar, and potatoes more starch than those grown in the shade. The author calls attention to the practice of shading crops in tropical climates and concludes that the intensity of light has its minimum, optimum, and maximum, although no exact experiments to determine these points have been made.

A series of experiments was made to ascertain the combined action of water and plant food, light and plant food, and light and moisture. The results indicated that the effect of fertilizers on the productive capacity of plants depends upon the moisture content of the soil to such an extent that the highest absolute yield from the application of fertilizers was obtained with a content of soil moisture corresponding to the optimum; that the applied fertilizer material produced the greatest increase in yield under the strongest light, and *vice versa;* that soil moisture produces its greatest effect upon plant growth when the plants are grown in the strongest light; and that the amount of water needed to produce a maximum yield exerts its full force only when the light passes to the plants unhindered.

No experiments were made by the author to study the effect of temperature on plant growth, but the results are tabulated and discussed of experiments made by Haberlandt, Sachs, and Bialoblocki with the common field crops, on the minimum, optimum, and maximum temperature for germination, the time required for germination, and the rate of growth of the root and plumule at different temperatures.

Autumn catch crops, P. P. Dehérain (*Ann. Agron., 23* (*1897*), *No. 12, pp. 561–575*).—The results of experiments with vetch and peas as catch crops in 1897 are reported in tables and the value of legumes for this purpose is pointed out in the discussion. The largest yields were obtained from plats which had received a small application of superphosphates in 1896 and upon which vetch had been grown in 1893. On a number of plats no vetches had been grown, but they had been sown to clover in 1894, and upon these the yields were much better than on plats which had not produced leguminous crops for a number of years. The author states that the quantity of nitrogen in the crops of the best-yielding plats approaches the quantity contained in 13 tons of meadow hay or 36 tons of barnyard manure, and calls attention to the fact that when the necessary moisture conditions prevail autumn catch crops are profitable as forage and green manures.

Barley—variety tests, W. W. COOKE (*Colorado Sta. Bul. 40, pp. 1–14*).—The author discusses barley growing in Colorado and describes the hulled and the hulless varieties. It is stated that "Success" barley, a hulless variety, which ripens its grain at an altitude of 7,000 ft. and is grown as a hay crop up to 8,500 ft., has been found profitable. The results of variety tests conducted for 10 years, begun in 1887, are given in tables. The author states that "White varieties of hulless barley have usually produced better than the black or purple, although some yields of the small plats of the purple have been very high." Among the malting varieties Chevalier gave the best results. In 1895 this variety, although lodged flat, yielded over 83 bu. of good solid grain per acre.

Wheat and barley raising in Denmark, C. SONNE (*Ugeskr. Landm., 43 (1897), No. 43, pp. 571–576*).—Of the arable land in Denmark fully 40 per cent is annually sown to the following cereals in the proportions given: Wheat, 5 per cent; rye, 27 per cent; barley, 28 per cent, and oats, 40 per cent. The author summarizes the results of trials with wheat and barley conducted by the Danish State Agricultural Society since 1882, during which about 12,000 plats have been sown to wheat and about 15,000 to barley at trial stations located in different parts of the country. As an average of 1,158 trials on heavy, medium, and light wheat soils, the Squarehead wheat yielded at the rate of 46.3 bu. per acre. This variety, introduced into Denmark in 1874, is now grown on at least 90 per cent of the wheat area of the country, and its introduction is estimated to have increased the yield by at least 10 bu. per acre. The following requirements for obtaining a maximum yield of Squarehead wheat under Danish conditions are the conclusions drawn from extensive culture tests: (1) A rich, clean, and well-drained, preferably loam soil; (2) the sowing of seed wheat of a good quality; (3) sowing in the middle of September; (4) the application of sufficient seed, about 3.4 bu. per acre when sown in drills.

The production of barley is largely for malting purposes. The varieties generally grown are Chevalier, Prentice, and Gold Thorpe. None of these combines in itself the qualities of a good malting barley, as in one or the other, according to the season or the soil, either the yield or the quality is not all that could be desired. The author considers the requirements for obtaining the best results in the culture of malting barley at some length.—F. W. WOLL.

Preliminary report upon the selection of potatoes for planting, H. L. BOLLEY (*North Dakota Sta. Bul. 30, pp. 210–243, figs. 17*).—The present status of the question regarding the form, part, and weight of the tuber piece to be planted is pointed out by citing from the conclusions drawn from experiments made at a number of stations. The influence of variations of varieties upon potato culture is discussed, and the author's work during 3 seasons in the selection of potatoes from the vine and the preparation of the seed are reported and conclusions drawn from the results.

Comparison was made of the growth from large and from small tubers selected from the same vine. In 1894 the tubers were selected from hills of normal growth, which indicated their origin to be from a single piece, and which showed considerable difference in growth, number, size, and form of the potatoes. The peculiarities of tubers from each hill were noted. Small tubers were selected from those weighing between $1\frac{1}{4}$ and 2 oz. and the large ones from those exceeding 6 oz. in weight. "The specific gravity of each tuber was then taken, which was found to be essentially the same for large and small tubers from the same hill, but often very different in different hills." After receiving the corrosive sublimate treatment for the prevention of scab one piece, an ounce in weight, was taken from the bud end of each selected tuber. These pieces were planted in the spring of 1895 3 ft. apart each way and 4 in. deep, with the cut surface down. Only one piece was planted in a hill. Soil condition and cultivation were as nearly alike for the entire crop as it was possible to make them. For this season the average weight per hill of the product in tubers grown from the small tubers at the time of digging was 2.1467 lbs. and the average weight per hill for those grown from large tubers was 1.92 lbs.

The tubers from most of the hills were planted the next season (1896) with the preparation already described. The hills from which no seed was planted in 1896 were those which had produced only large or only small tubers. The average yield per hill in 1896 was 26.54 oz. for those planted with pieces of small potatoes and 25.45 oz. for those planted with pieces of large potatoes, a difference of 1.09 oz. per hill in favor of the small potatoes. In 1897 work was continued, but weather conditions made the crop of no value for the details of comparison.

The author concludes from the results that "the weight of the piece has very little to do with the number of stalks which appeared in the hill," and adds that he is inclined to attribute the variability in the number of stalks produced from the pieces of like weight and pedigree chiefly to conditions affecting the vigor of first growth of the sprouts.

It was found that the number of tubers per hill increased quite regularly with the number of stalks produced. "The conclusion is that, with a comparatively stable strain, any condition which results in an increase of stalks per hill will likewise result in a nearly proportionate increase of tubers per hill."

In summarizing the observations of the 3 years the author makes the following statements:

"Because of the tendency of potatoes to vary under cultivation, and because such variations tend to run into certain strains, some valuable and others comparatively valueless, it is evident that the selection of proper tubers for planting is the first essential to culture. This selection should be done in the field at digging time, and should be made from those hills which produce potatoes of the form and character desired.

"In planting equal weight pieces from small and large tubers of the same vine there will not be a sufficent difference in favor of one or the other size of potatoes to be noticed under farm methods, provided all are normally mature."

Further tests of northern and home grown seed potatoes, C. O. FLAGG and G. M. TUCKER (*Rhode Island Sta. Rpt. 1896, pp. 344–353*).—A continuation of work reported in a former bulletin of the station (E. S. R., 8, p. 217). This was the third year that seed tubers were obtained from Maine to compare northern and home grown seed. In general, the same varieties were brought from Maine each year and grown in Rhode Island for 2 and 3 years in succession. Tabulated results show the degree of maturity and the average yields, weights, and number of tubers obtained.

The averages for all the varieties of Maine seed grown at the station 1, 2, and 3 years are given in the following table:

Yield from Maine potatoes grown in Rhode Island 1, 2, and 3 years.

	Average weight of—			Proportion of large tubers.		
	All tubers.	Large tubers.	Small tubers.[1]	1896 by number.	1896 by weight.	1895 by weight.
	Pound.	*Pound.*	*Pound.*	*Per cent.*	*Per cent.*	*Per cent.*
From seed grown 1 year	0.135	0.27	0.10	22.17	43.05	72.77
From seed grown 2 years	.120	.25	.09	20.25	35.84	69.45
From seed grown 3 years	.120	.25	.10	19.45	38.41	....

[1] In 1896 all tubers weighing 3 oz. or more and in 1895 those weighing 2 oz. or more were classed as large tubers.

In summarizing, the authors state that the total yield of the northern-grown seed was 28.42 bu. per acre less the first year than for seed grown at the station for 2 years, and 17.02 bu. less than from seed grown at the station 3 years, but that the increase in the crop from the home-grown seed consisted of tubers less than 3 oz. in weight.

"The yield of tubers 3 oz. or more in weight was 1.29 bu. greater than the home-grown second-year seed and 2.21 bu. per acre greater than was obtained from the home-grown third-year seed."

The more important cultivated plants of German colonies and their products, R. SADEBECK (*Die wichtigeren Nutzpflanzen und deren Erzeugnisse aus den deutschen Kolonien. Hamburg: Lucas Gräfe & Sillem, 1898, pp. 138*).

Forage crops, I. P. ROBERTS and L. A. CLINTON (*New York Cornell Sta. Rpt. 1897, pp. 271-296, figs. 6*).—A reprint of Bulletin 135 of the station (E. S. R., 9, p. 341).

Jackson Limbless cotton, R. J. REDDING (*Georgia Sta. Press Bul. 36, pp. 2*).—A report on a test of 21 varieties of cotton, including the so-called Jackson Limbless. The author describes the merits of this variety. He believes it to be identical with Welborn Pet.

Potato culture, I. P. ROBERTS and L. A. CLINTON (*New York Cornell Sta. Rpt. 1897, pp. 151-163, figs. 4*).—A reprint of Bulletin 130 of the station (E. S. R., 9, p. 343).

The sugar beet, H. J. WATERS (*Missouri Sta. Bul. 40, pp. 16, fig. 1*).—This bulletin contains a tabulated report of the cooperative experiments with sugar beets in 1897. From 90 counties 304 samples were obtained and analyzed. The average weight of the beets in the samples was 26 oz., the average percentage of sugar in the juice 11.14, and the average coefficient of purity 71. Of the samples analyzed 117 contained 12 per cent or more of sugar in the juice. These samples were furnished by 73 counties. Notes are given on previous experiments in this line and on the weather conditions for the season of 1897.

Distribution of seeds and plants, E. J. WICKSON (*California Sta. Bul. 118, pp. 8*).—Brief reports are given of the seeds and plants distributed by the station and descriptions and lists given of those offered for distribution during the coming season.

HORTICULTURE.

Latitude and plant growth, L. C. CORBETT (*West Virginia Sta. Rpt. 1896, pp. 178-193, pls. 4*).—This is an extract from a thesis on this subject. Instances of the effect of climate on the growth of grapes, Russian apples, and corn are noted, and the results of experiments with cuttings and seeds of various plants are given.

In 1889–'90 cuttings of Concord grapes from New Jersey, Virginia, and New York were compared, all having received the same treatment after the experiment began. The New York cuttings started growth earlier than the others and a greater percentage of them grew. Fay Prolific and White Grape currant cuttings from New York and New Jersey showed practically no difference, either in time of starting or in vigor of growth. Cuttings of poplar, 24 from New York and 24 from Virginia, were planted at the same time and given the same treatment. Two weeks after planting all the New York cuttings, but none of the Virginia cuttings, had started growth. At the end of 3 weeks 11 of the Virginia cuttings had started. About 6 weeks after planting all of the Virginia cuttings had started, but the New York cuttings were then at least one-third more advanced. In the case of Meech Prolific quince, 6 out of 14 cuttings from New York and only 1 out of 14 from New Jersey had started growth 2 weeks after planting. Of the Orange quince 7 out of 11 cuttings from New York and none of the 9 cuttings from New Jersey had started 2 weeks after planting.

In 1891–'92, 37 cuttings of Lombardy poplar from Maine were compared with 39 cuttings from New York. About 6 weeks after planting the Maine cuttings had made an average growth of 1.96 in. and the New York cuttings 1.64 in. A comparison was made of 30 cuttings of the Concord grape from Maine, 32 from New York, and 23 from Louisiana.

About 6 weeks after planting, the Maine cuttings had made an average growth of 2.66 in., the New York cuttings 1.6 in., and the Louisiana cuttings 1.3 in. The difference in the growth of the grape and poplar cuttings from different States is shown in plates.

Potatoes from Maine and New York were grown under like conditions in a greenhouse. Crane June Eating potatoes of New York stock and grown for a single season in Maine were compared with others of the same stock grown continuously in New York. Similarly, Early Rose potatoes of Maine stock and grown in New York but a single season previous to the experiment were compared with others of the same stock grown continuously in Maine. Little difference was observed in the rapidity of germination in either case between the Maine and the New York potatoes. In both cases the plants from tubers grown in Maine had much darker green foliage, grew larger, and yielded a larger crop than plants from tubers grown in New York. The increased yield was shown in the greater size rather than in the greater number of tubers produced.

A number of experiments on the germination of seeds of various varieties of corn, beans, and watermelons grown in the North and the South are quoted from a thesis presented to Cornell University by Messrs. Royce and Atwood. The results indicated that northern-grown seeds germinate somewhat more rapidly than southern-grown ones.

The author believes that these experiments are sufficient to establish the superiority of northern-grown seeds, potato tubers, and hard-wood cuttings, a northern climate having a tendency to hasten development and increase yield.

Mixed graftage, L. DANIEL (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 18, pp. 661–664; also in Rev. Hort., 69 (1897), No. 24, pp. 566–568, and Bul. Mens. Soc. Cent. Agr., Hort. et Acclim.* [*Nice*], *37 (1897), No. 12, pp. 229–233*).—The author describes a method which he calls mixed graftage (la greffe mixte), and reports some experiments comparing it with the ordinary method. The method differs from the ordinary method in that a few shoots are allowed to grow permanently upon the stock and are kept pruned sufficiently to prevent their seriously checking the growth of the scion.

By means of mixed graftage a successful union of a scion of the wild cherry (*Cerasus avium*) with the cherry laurel (*Prunus lauro-cerasus*) as a stock was readily effected, a union which is considered very difficult to secure on account of the widely different characteristics of the 2 trees, one having deciduous and the other persistent leaves.

In order to compare the effect of ordinary graftage with that of mixed graftage, 2 very unlike haricots, the large haricot of Soissons and the black Belgian haricot, were used. In case of both methods of graftage the black Belgian haricot was used as the scion and the large haricot of Soissons as the stock. The grafted plants were grown together with nongrafted ones of both sorts under the same conditions of soil and exposure. The large haricot of Soissons grew to a height of 450 cm., had many large leaves, long racemes of some 20 yellowish-white flowers, producing from 3 to 5 fruits with white seeds; the fruit had a decidedly disagreeable taste. The black Belgian haricot grew to a height of 40 cm., had numerous leaves and short racemes of 3 to 5 violet-colored flowers, producing from 2 to 3 fruits with dark violet seeds; the fruit was tender and of a very agreeable taste.

The plants resulting from ordinary graftage of the black Belgian haricot on the large haricot of Soissons grew to be 25 cm. high, had fewer and lighter green leaves than the nongrafted black haricot, and racemes of 2 to 3 violet-colored flowers, producing 1 to 2 fruits with dark violet seeds. The fruit had a taste resembling somewhat that of the large haricot of Soissons. The plants resulting from mixed graftage of the black Belgian haricot upon the large haricot of Soissons were 40 cm. high and had leaves like the nongrafted black haricot. Some of the flowers were of a violet color, others variegated white and violet; 1 raceme was long, having 9 variegated flowers, producing 3 fruits, and the other racemes were short like those of the black Belgian haricot. The fruit had a taste decidedly like that of the large haricot of Soissons; and the seeds were of a dark violet color.

Some of the conclusions which the author draws from these experiments are: Mixed graftage should be used with plants presenting any marked differences, as those between deciduous and evergreen trees. The stock does not influence the scion in the same way in cases of mixed graftage as of ordinary graftage. Such characteristics as may be attributed to variations of environment (height, vigor, resistance to parasites, etc.) are affected less by the stock in the case of mixed graftage than of ordinary graftage. On the other hand, characteristics peculiar to the variety of the stock (flavor, form of fruits, color of flowers, etc.) mix with those of the scion much more readily with mixed than with ordinary graftage.

Vegetables, L. C. CORBETT (*West Virginia Sta. Bul. 49, pp. 467–507, figs. 2*).—The bulletin reports culture and variety tests of a number of vegetables.

A test of hill *vs.* drill planting of beans resulted in favor of drill planting; 2 lbs. of seed planted in drills yielded a product of 140.4 lbs., while the same quantity of seed planted in hills yielded a product of only 50.7 lbs. A similar test made by the author in South Dakota is quoted (E. S. R., 8, p. 790). Large White Lima beans were planted on inverted sods in the greenhouse March 27, April 3, and April 10, and in the open May 7. The largest yield was obtained from the planting of April 3, the next largest from that of April 10, and the smallest from the May planting. A tabular statement of the yield of 6 varieties of bush beans and 4 varieties of bush Lima beans is given.

A test was made of planting peas at depths of 2, 3, 4, 6, and 8 in. Peas planted 3 in. deep gave the highest percentage of germination and a greater yield than those planted at other depths. The time of maturity was not materially affected by the depth of planting. In the fertilizer test with tomatoes, sulphate of potash, muriate of potash, bone meal, and nitrate of soda were used singly and in various combinations. The use of nitrate of soda alone gave the smallest yield and the fewest fruits per plant. Bone meal gave the best results of any single fertilizer and sulphate of potash the next best. Sulphate of potash proved much superior to muriate of potash, both when used alone and when used in combination with nitrate of soda. Of the various combinations of fertilizers a mixture of equal parts of the 4 fertilizers used gave the best results.

Tomatoes pruned after the fruit set produced a greater number of ripe fruits per plant up to September 1 than unpruned plants, but the total yield per plant for the whole season was less. Of the various methods of pruning tomatoes, the single-stem method gave somewhat earlier and larger fruits, but lessened the total yield considerably. Tomatoes trained on racks gave a larger yield than on any other kind of trellis.

Seed of Dwarf Champion tomatoes was sown at intervals of 10 days from February 10 to April 10. The largest crop was obtained from seed sown about March 1.

The use of a straw mulch increased the yield of tomatoes and decreased the amount of rot, the average weight of fruit per plant being 14.6 lbs. in case of the mulched plants, and 12.2 lbs. in case of the plants without mulch, and the percentages of rot 0.97 and 1.88, respectively.

Various methods of handling tomato plants previous to setting them in the field were tested. Part of the plants were left in the seed bed until ready to be planted in the garden and were then set in the soil with a dibble. Another lot of plants was treated in the same way, except that they were set in holes previously dug for them. The third lot was transplanted from the seed beds to flats, later transferred to other flats, and when removed to the field holes were dug for them. A fourth lot was treated like the third, except that the plants were transplanted from the first flat to 1-quart vegetable cans. A fifth lot was also treated like the third. except that the plants were set in the garden with a dibble. A sixth lot was transplanted from the seed bed into 2-inch pots, transferred to 3½-inch pots, and when set in the garden holes were dug for them. The plants from pots gave the best results and those from vegetable cans next best. The difference between the other methods was not very great. The author considers the increased yield due to growing young plants in pots sufficient to repay the extra expense made necessary by the use of pots.

A test of tomato cuttings *vs.* seedlings for forcing house culture resulted decidedly in favor of the seedlings. From experiments with seedlings and cuttings for outdoor culture, the author concludes that cuttings give more, earlier, and smaller fruit than seedlings.

The results of a test of a number of varieties of tomatoes are reported in tabular form. The excessive rainfall of July caused irregularities in the setting of fruit. From the test the author concludes that "large size in fruits is incompatible with great numbers," and that "the greatest yield in bushels is to be expected from plants producing fruits of medium large size."

Apples, L. C. CORBETT (*West Virginia Sta. Rpt. 1896, pp. 199–215, pls. 15*).—This is a popular article discussing the adaptability of West Virginia to apple growing, the orchards of northern West Virginia, the management of orchards, the packing and care of fruit, the longevity of fruit trees, etc.

In regard to pruning the author urges that the method used be made to correspond to the peculiarities of the variety, rather than that a particular method be used in all cases. For instance, in case of the King and Willow varieties of apples, which bear a large part of their fruit near the outer ends of their long, slender, decumbent branches, heading-in should be practiced. On the other hand, with such varieties as Ben Davis and Baldwin apples, which have a more compact form and a better distribution of fruit, thinning the branches should be practiced.

Instances are cited to show the effect of top grafting and root grafting on the longevity of some varieties of fruits. Trees of the King apple, top worked on seedlings and now 20 years old are in fairly good condition, while others of the same variety, root grafted and set in the same orchard at the same time, have been dead for 10 years. Ten top-grafted and 10 root-grafted Walldow apples were set in an orchard at the same time. The top-worked trees at the age of 20 years are living and thrifty, while of the root-grafted trees only one limb of one tree is living, the majority of the trees having died between the ages of 5 and 10 years. In an apple orchard planted with 100 root-grafted and 70 top-grafted trees, 44 per cent of the former and only 7.2 per cent of the latter have died. In propagating varieties of apples that have weak trunks, top grafting or, even better, double working is recommended. For double working, Tolman Sweet is considered a good variety, since "it possesses a close, smooth bark, a strong yet not rapid growth, and a great length of life."

Strawberries, J. T. STINSON (*Arkansas Sta. Bul. 48, pp. 119–140, figs. 5*).—The bulletin gives general information on strawberry growing in the State and the results obtained at the station. Descriptive notes are given on 43 varieties of strawberries grown at the station and on 23 varieties grown in other parts of the State. A summary of results reported in previous publications of the station is given, and the varieties which have since been discarded are noted.

The culture of strawberries is discussed in a popular way, preparation of soil, setting plants, perfect and imperfect varieties, cultivation, mulching, renewing old beds, implements, crates for marketing, and the like being considered. Mulching strawberry beds was found to increase the yield of fruit fully one-third. A portion of each row of about 50 varieties were mulched and a portion of each row left unmulched. The yield was increased by mulching in every case, but the increase varied considerably with the different varieties, being greatest with the large-fruited and medium to late varieties.

Vine pruning, F. T. BIOLETTI (*California Sta. Bul. 119, pp. 16, figs. 11*).—This is a popular bulletin discussing the principles and methods of grape pruning and training adapted to California conditions. The discussion is based upon experiments at the station, observations throughout the State, and a study of foreign methods.

The bulletin states 8 physiological principles connected with pruning and training, describes a typical vine, and gives the names of the different parts, discusses pruning for wood and for fruit, shows the method of making the cut in pruning, describes and illustrates several systems of pruning and training and gives a list of varieties adapted to each system, discusses various modes of summer pruning, and the like. The kind of treatment to be given in any case depends upon the habit of growth of the variety and upon the fertility of the soil.

Extension work in horticulture, L. H. BAILEY (*New York Cornell Sta. Rpt. 1896, pp. 161–206*).—A reprint of Bulletin 110 of the station (E. S. R., 8, p. 135).

Second report of extension work in horticulture, L. H. BAILEY (*New York Cornell Sta. Rpt. 1896, pp. 533–564, figs. 14*).—A reprint of Bulletin 122 of the station (E. S. R., 8, p. 790).

Horticulture in Germany and Austria, L. AGA (*Tidsskr. Norske Landbr., 4 (1897), No. 7–8, pp. 304–339*).

Horticulture in Germany: Business directory of market gardeners, seedsmen, and nurserymen of Germany, with a list of the horticultural societies, F. J. M. PLUMPE (*Der Gartenbau im deutschen Reiche: Handels-addressbuch der Handelsgartnereien, Samenhandlungen, Baumschulenbesitzer Deutschlands, mit Angabe der Gartenbauvereine. Berlin: F. J. M. Plumpe, 1893, 4. ed. enl., pp. 356*).

West African oil palm (Elæis guineensis), E. COWLEY (*Queensland Agr. Jour., 1 (1897), No. 6, pp. 458–461, pls. 2*).—Notes on culture, extraction of oil, etc.

Coffee growing in Queensland, F. HEPBURN (*Queensland Agr. Jour., 1 (1897), No. 6, pp. 454–457*).

The culture of chicory and its manufacture, J. STORME (*Culture et fabrication de la chicorée à café. Louvain: A. Uystpruyst, 1896, pp. 52*).

Fruit brevities, L. H. BAILEY (*New York Cornell Sta. Rpt. 1896, pp. 408–456, figs. 14*).—A reprint of Bulletin 117 of the station (E. S. R., 8, p. 311).

The marketing of fruits, L. H. BAILEY (*Pennsylvania Dept. Agr. Rpt. 1896, pp. 533–548, pls. 3, figs. 2*).—The picking, assorting, packing, and shipping of various fruits and different styles of fruit packages are considered. A list of firms manufacturing fruit packages in the Eastern States is given.

Critical notes on varieties of fruit, vegetables, etc., in the station garden, L. F. KINNEY (*Rhode Island Sta. Rpt. 1896, pp. 188–191, figs. 2*).

Practical guide to gardening, S. MOTTET (*Petit guide pratique de jardinage. Paris: Octave Doin, 1897, 2. ed. enl., pp. 362, figs 317.*)—A book on vegetable and fruit culture, floriculture, and the culture of ornamental trees and shrubs.

Vegetable gardening, C. L. NEWMAN (*Arkansas Sta. Rpt. 1897, pp. 3–48*).—A reprint of Bulletin 44 of the station (E. S. R., 8, p. 976).

Vegetables under glass, H. A. DREER (*Philadelphia: Henry A. Dreer, 1896, 2. ed., pp. 101, figs. 44*).—The management of greenhouses, hotbeds, and cold frames, and the forcing of vegetables.

Open-air vegetables, H. A. DREER (*Philadelphia: Henry A. Dreer, 1897, pp. 148, figs. 60*).—The book gives the culture requirements of the vegetables commonly grown out of doors.

Asparagus culture, O. ELSNER (*Landw. Wchnbl. Schleswig-Holstein, 48 (1898), No. 5, pp. 87–89*).

The pole Lima beans, L. H. BAILEY (*New York Cornell Sta. Rpt. 1896, pp. 347–372, figs. 17*).—A reprint of Bulletin 115 of the station (E. S. R., 8, p. 128).

Celery, W. M. MUNSON (*Maine Sta. Bul. 40, pp. 8*).—A popular article on celery culture, including notes on soil, fertilizers, starting plants, cultivation, blanching, storage, etc.

Experiments with fertilizers on celery, L. H. BAILEY (*New York Cornell Sta. Rpt. 1897, pp. 221–230, figs. 7*).—A reprint from Bulletin 132 of the station (E. S. R., 9, p. 350).

Radishes, H. DE VILMORIN (*Rev. Hort., 70 (1898), No. 4, pp. 83–86, pl. 1*).

Apples, L. C. CORBETT (*West Virginia Sta. Bul. 47, pp. 435–451, pls. 5*).—A reprint from the Annual Report of the station for 1896 (see p. 948).

Dwarf apples, E. G. LODEMAN (*New York Cornell Sta. Rpt. 1896, pp. 376–404, figs. 5*).—A reprint of Bulletin 116 of the station (E. S. R., 8, p. 226).

Fig caprification, N. B. PIERCE (*California Fruit Grower, 22 (1898), No. 10, p. 4*).

Green crops in orchards, L. F. KINNEY (*Rhode Island Sta. Rpt. 1896, p. 188*).—A brief note on the use of crimson clover and cowpeas in orchards.

Lemon growing and curing, W. S. WILLIAMS (*Queensland Agr. Jour., 1 (1897), No. 6, pp. 444–447*).

Japan plums, E. O. ORPET (*Amer. Gard., 19 (1897), No. 163, p. 110*).

Revised opinions of Japanese plums, L. H. BAILEY (*New York Cornell Sta. Rpt. 1896, pp. 39–67, figs. 13*).—A reprint of Bulletin 106 of the station (E. S. R., 8, p. 50).

Notes upon plums for western New York, S. D. WILLARD and L. H. BAILEY (*New York Cornell Sta. Rpt. 1897, pp. 167–195, figs. 12*).—A reprint of Bulletin 131 of the station (E. S. R., 9, p. 351).

Raspberries, L. C. CORBETT (*West Virginia Sta. Bul. 48, pp. 454–464, figs. 4*).—A popular article read before the West Virginia State Horticultural Society. It treats of propagation, planting, pruning, cultivation, harvesting, evaporating, construction of evaporators, etc.

Why not grow raspberries? L. C. CORBETT (*West Virginia Sta. Rpt. 1896, pp. 215–225, figs. 4*).—A reprint of Bulletin 48 of the station (see above).

Raspberry culture, E. F. AUGUSTINE (*Canad. Hort., 21 (1898), No. 3, pp. 90–94, figs. 6*).—A reprint from Ontario Farmers' Institute Report for 1897.

Strawberries, F. T. STINSON (*Arkansas Sta. Rpt. 1897, pp. 119–140, figs. 5*).—A reprint of Bulletin 48 of the station (see p. 948).

Strawberries under glass, C. E. HUNN and L. H. BAILEY (*New York Cornell Sta. Rpt. 1897, pp. 261–268, figs. 2*).—A reprint of Bulletin 134 of the station (E. S. R., 9, p. 353).

Chestnut possibilities in Pennsylvania (*Pennsylvania Dept. Agr. Rpt. 1896, pp. 410–414*).

Outlines of agricultural and horticultural work, L. C. CORBETT (*West Virginia Sta. Rpt. 1896, pp. 165–175, 244–248*).—The work done during 1896 and experiments to be made during 1897 are noted. A list of donations to the horticultural department in 1896 is given.

A "mixed" method of grafting (*Gard. Chron., 3. ser., 23 (1898), No. 580, p. 84*).—A review of the work of Daniel (E. S. R., 9, p. 945).

Cuttage, S. MOTTET (*Rev. Hort., 70 (1898), No. 2, pp. 41–45, figs. 9*).—Some of the physiological principles concerned in cuttage are noted.

Cuttage, L. C. CORBETT (*West Virginia Sta. Rpt. 1896, pp. 175–178*).—An extract from a thesis on this subject. It discusses the importance and necessity of cuttage.

The 1895 chrysanthemums, L. H. BAILEY, W. MILLER, and C. E. HUNN (*New York Cornell Sta. Rpt. 1896, pp. 259–292, figs. 12*).—A reprint of Bulletin 112 of the station (E. S. R., 8, p. 130).

Chrysanthemums in 1896, L. H. BAILEY and W. MILLER (*New York Cornell Sta. Rpt. 1897, pp. 300–320, figs. 8*).—A reprint of Bulletin 136 of the station (E. S. R., 9, p. 356).

Subirrigation for chrysanthemums, L. R. TAFT (*Amer. Florist, 13 (1898), No. 510, pp. 881, 882*).

The cistuses (*Garden, 53 (1898), No. 1369, pp. 130–132, figs. 5*).—Cultural and descriptive notes.

A talk about dahlias, W. MILLER (*New York Cornell Sta. Rpt. 1897, pp. 99–136, figs. 9*).—A reprint of Bulletin 128 of the station (E. S. R., 9, p. 339).

Hyacinth propagation, S. B. DICKS (*Florists' Exchange, 10 (1898), No. 11, p. 270, figs. 3*).

The Nepenthes and their culture; a botanical and horticultural study of the Nepenthes, J. RUDOLPH (*Les Nepenthes et leur culture; étude botanico-horticole sur les Nepenthes. Paris: Octave Doin, 1896, pp. 31, figs. 5*).

Exotic orchids and their culture in Europe, L. LINDEN, A. COGNIAUX, and G. GRIGNAN (*Les orchidées exotiques et leur culture en Europe. Paris: Octave Doin; Brussels: L. Linden, A. Cogniaux, and G. Grignan, 1894, pp. 1019, figs. and pls. 141*).—The work is divided into 4 parts. The first part treats of the classification and geographical distribution of orchids, with a bibliography of the subjects. The second part has to do with the history of the cultivation of orchids, their habitat, and the importation of them. The third part discusses in detail the culture of orchids in Europe. The fourth part gives descriptions of the principal orchids grown in Europe.

Dictionary of hybrid orchids, E. BOHNHOF (*Dictionnaire des orchidées hybrides. Paris: Octave Doin, 1895, pp. 139*).—The first part of this book contains an alphabetical list of all artificial and natural orchid hybrids known to the author up to the year 1895, the name of the originator or introducer of each, the date of its introduction, and the names of its seed-parent and pollen-parent. The second part of the book gives tables to facilitate finding the parentage and synonyms of hybrids, etc. The title-page, preface, and all explanations of tables are given in French, German, and English.

Tufted pansies, D. B. CRANE (*Garden, 53 (1898), No. 1370, pp. 148, 149, pl. 1, figs. 2*).

Zonal pelargoniums as pot plants, H. SHOESMITH (*Garden, 53 (1898), No. 1370, pp. 154, 155*).—Notes on culture and propagation.

Sweet peas, L. H. BAILEY and A. P. WYMAN (*New York Cornell Sta. Rpt. 1896, pp. 211–253*).—A reprint of Bulletin 111 of the station (E. S. R., 8, p. 131).

A second account of sweet peas, A. G. WYMAN and M. G. KAINS (*New York Cornell Sta. Rpt. 1897, pp. 63–95, figs. 2*).—A reprint of Bulletin 127 of the station (E. S. R., 9, p. 356).

Water cress: Its history and cultivation, W. W. GLENNY (*Garden, 53 (1898), No. 1369, pp. 124–126*).—Taken from the Journal of the Royal Agricultural Society of England.

Suggestions for the planting of shrubbery, L. H. BAILEY (*New York Cornell Sta. Rpt. 1896, pp. 502–529, figs. 29*).—A reprint of Bulletin 121 of the station (E. S. R., 8, p. 495).

Hints on formed trees, F. JAEKEL (*Pennsylvania Dept. Agr. Rpt. 1896, pp. 558–568, figs. 11*).—Various modes of training fruit trees are described.

Trees to adorn streets, W. R. SMITH (*Florists' Exchange, 10 (1898), No. 10, pp. 240, 241; Amer. Florist 13 (1898), No. 509, pp. 845, 846*).—An address before the Massachusetts Horticultural Society.

Moisture the plant's greatest requirement, J. C. ARTHUR (*Amer. Florist, 13 (1898), No. 508, pp. 813, 814; Florists' Exchange, 10 (1898), No. 9, pp. 215, 216, fig. 1; New England Florist, 4 (1898), No. 1, pp. 3–5*).—A paper read before the American Carnation Society at Chicago. It deals with the water requirements of plants, with special reference to carnation culture. The author believes that a constant stream of water through the plant is required for healthful development and recommends that carnations be grown in an atmosphere sufficiently dry to insure considerable evaporation from their leaves and that, to keep the air from becoming too moist, subwatering be practiced. Other advantages of subwatering are also noted.

McGregor's new book on growing flowers, MCGREGOR BROS. (*Sgringfield, Ohio: McGregor Bros., 1897, pp. 104*).—A book of practical suggestions on the care and management of flowers in the house and garden, with culture directions for such plants as require special treatment.

FORESTRY.

Afforestation of abandoned fields on the Biltmore estate, C. A. SCHENCK (*Forester, 4 (1898), No. 4, pp. 78–80*).—A report is given of the cost of planting in the fall of 1897 about 45 acres of abandoned fields on the Biltmore estate. These fields had been exhausted or the slope of the ground was too steep to permit of profitable use for field crops or pasturage. The varieties of seed planted were walnut, buckeye, white oak, chestnut oak, hickory, red oak, and chestnut. The total expense of the planting, except that of the salary of the ranger who superintended the work, and allowance for wear and tear of tools is given.

The white and chestnut oak seeds were planted 4 in. apart in the rows, the buckeye and red oak 8 in., and the walnut and hickory 12 in. The rows were 3 to 4 ft. apart, according to the slope of the ground, those on the steep slopes being a wider distance apart so as to allow cultivation without injury to the seedlings. The aggregate expenses are said to be higher than necessary under ordinary conditions of afforestation, as there was a desire for quick results.

In order to check the ravages of field mice it was necessary to cultivate the different plantations about four times at a cost of about 40 cts. per acre. After about the third growing season the roots of the seedlings will be strong enough to offer resistance.

The cost of planting an acre varied from $5.70 in the case of chestnuts to $16.20 in one of the white oak plantations. However, the author states that the average cost should not exceed $12 per acre.

Assuming that the plantations will be ready for cutting within 100 years, and placing a fair estimate upon the present value of the land, taxes, administration, etc., the author states that the indications are favorable to a production which will represent 2½ per cent compound interest on the investment. This would require a stumpage of about 40,000 B. M. per acre. In addition to the yield of lumber there will be immediate returns in the way of firewood, tan bark, fence posts, seeds, etc., which will render the interest on the capital invested considerably higher than the amount stated.

Trees from South Asia acclimated in southern California, I, F. FRANCHESCHI (*Forester, 4 (1898), No. 4, pp. 76, 77*).—The author calls attention to a number of species of Eucalyptus, Acacia, Grevillea, Casuarina, Araucaria, etc., which have not only become well established in southern California, lending their peculiar features to the landscape, but have also become of very considerable economic value, the Eucalyptus furnishing the chief supply of fuel for that region. In addition to these Australian trees the following from South Asia have shown themselves adapted to the conditions found in southern California: *Michelia champaca, Flacourtia ramontchi, Pittosporium nilghirense, Kayea eugeniæfolia, Gordonia anomala, Hibiscus rosa sinensis, H. mutabilis, Kydia calycina, Reevesia thyrsoidea, Berrya ammonilla, Murraya exotica, Glycosmis pentaphylla, Clausenia wampi, Garuga pinnata, Bursera serrata, Melia azedarach, Aglaia odorata, Cedrela toona, C. serrata, Euonymus tingens, Hovenia dulcis, Sapindus utilis,* and *Nephelium lit-chi.*

The reforesting of the sand hills of Nebraska, C. E. BESSEY (*Nebraska State Bd. Hort. Rpt. 1897, pp. 38–44, map 1*).—The author describes the general characteristics of the sand-hill region of the State. This region, which embraces from 15,000 to 20,000 square miles, the author thinks possible to reforest in the following manner: "The setting apart of large areas for forests by the General Government, which still owns a greater part of the land of this region; the stoppage of prairie fires over this region; inclosure of the lands so as to exclude herds of cattle; the planting of small areas scattered over these forest tracts with hardy shrubs and trees of rapidly spreading kinds; the careful supervision of these forest areas by competent keepers."

The effects of Arbor Day upon economic forest planting, J. STERLING MORTON (*Forester, 4 (1898), No. 4, p. 72*).

Park management and forestry (*Forester, 4 (1898), No. 4, pp. 73, 74*).

Essentials in park planting, W. H. MANNING (*Forester, 4 (1898), No. 4, pp. 74, 75*).

Forest seed selection, C. A. KEFFER (*Forester, 4 (1898), No. 4, pp. 77, 78*).

Forestry in Virginia, J. GIFFORD (*Forester, 4 (1898), No. 4, pp. 80–82*).

Forest destruction and waterflow, southern California, II, A. KINNEY (*Forester, 4 (1898), No. 4, pp. 82, 83*).

An old plantation of Pinus strobus, LOREY (*Allg. Forst u. Jagd Ztg., 74 (1898), No. 2, pp. 43–45*).—Compares the growth of white pine with fir, hemlock, etc., of known age.

Degrees of thinning forests, A. C. FORBES (*Gard. Chron., 3. ser., 23 (1898), No. 581, pp. 97, 98*).

Fire wounds, L. C. CORBETT (*West Virginia Sta. Rpt. 1896, pp. 226–235, pl. 1*).—The author discusses the injurious effects of forest fires and the value of second-growth timber which springs up after the original forest has been destroyed.

SEEDS—WEEDS.

Investigations concerning the methods of seed testing, especially of grass seed, R. HARTLEB and A. STUTZER (*Jour. Landw., 45 (1897), No. 1, pp. 43–60, figs. 2*).—The authors criticise the official regulations for seed testing,[1] and suggest various sources of possible

[1] Landw. Vers. Stat., 47 (1896), p. 231.

error. The kind of seed bed, ventilation, evolution of oxygen, temperature, light, and duration of the test are all stated as of great importance in seed testing.

The methods for purity examination are considered at considerable length and a form of apparatus designed to assist in this determination is figured and described.

The kind of seed bed, especially when testing grass seeds, is shown to be of great importance, examples being quoted in which the germination of samples of grass seed averaged 66 per cent for the Nobbe apparatus, 91 for filter paper, and 44 for open earth.

The influence of temperature on germination is shown. For some grasses, as well as for beet, carrot, and other seed, a constant temperature of 30° C. seems to be the best. This is in direct opposition to the regulations of the German Seed Control, as they recommend 30° C. for 6 hours daily, after which the thermostat is to be kept at about 20° C. Of the species of seed recommended to be so treated the authors report tests of Agrostis, Aira, Glyceria, Holcus, Poa, Dactylis, beet, and carrot seed, in which from 7.5 to 26 per cent higher germinations were secured when the higher temperature was maintained throughout the experiments.

The importance of a sufficient supply of oxygen and the proper amount of moisture in the seed bed is pointed out. The results of a number of experiments in which there was an insufficient supply of oxygen are tabulated, in which the deficiency attributed to this cause varied from 1.5 to 50 per cent. The preliminary soaking of ordinary seed before placing them in the seed bed is without ultimate effect, although seeds with hard seed coats may be benefited by a brief soaking in hot water.

The effect of light on the germination of seeds is commented upon and in the case of seed of *Poa* spp. it exerts a very beneficial effect, as is shown in the following table. All seed were germinated in thermostats at a temperature of 30° C., the comparisons being made of seed from the same lots.

Effect of light on germination of grass seed.

	In direct sunlight.	In diffused light.	In darkness.
	Per cent.	*Per cent.*	*Per cent.*
Poa pratensis	86.5	29.25	8.25
Poa pratensis (old seed)	49.0	11.00	3.50
Poa trivialis	94.0	36.25	13.00
Poa nemoralis	71.0	53.50	14.25
Poa nemoralis (old seed)	43.0	19.50	8.00

The authors describe in considerable detail their method for germinating grass seed, for which purpose they prefer a seed bed of filter paper. Sand seed beds are also described.

The question as to the proper duration of a test of seed is considered and numerous examples are cited in which the time usually given is shown to be too short.

In conclusion the authors have given in tabulated form the most important data regarding the germination of 22 of the more common grass seeds.

Concerning the effect of formic aldehyde on germination, R. WINDISCH (*Landw. Vers. Stat., 49 (1897), No. 3, pp. 223-226*).—A report is given of experiments with wheat, barley, oats, and rye in which the seed was soaked for 24 hours in solutions of formic aldehyde varying in strength from 0.02 to 0.4 per cent, comparisons being made with seed soaked for the same time in distilled water. The seed was germinated between layers of filter paper which were kept constantly moistened, and the seedlings were counted every 24 hours. The duration of the experiments was from 12 to 16 days. It was found that the weakest solution retarded the germination of barley, wheat, and rye, but was favorable to the germination of oats. The strongest solution injured all the seed. The following table shows the average percentage of seed of each kind that germinated under the influence of the different strengths of the solution:

Effect of formic aldehyde on germination.

Kind of seed.	Distilled water.	Strength of solution.					
		0.02	0.04	0.08	0.12	0.20	0.40
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Barley	96.50	95.50	97.50	89.00	47.00	0	0
Wheat	98.00	97.25	97.25	88.50	9.25	0	0
Oats	97.00	99.50	99.25	96.50	95.50	64.5	0
Rye	96.25	93.50	91.50	65.25	20.50	0	0

In every case there were duplicate experiments, and where the difference was more than 5 per cent the experiments were repeated.

Germination tests in soil and in bare earthen cups, L. F. KINNEY and G. E. ADAMS (*Rhode Island Sta. Rpt. 1896, pp. 193-202*).—The authors report upon parallel tests of 151 lots of seeds in which the germinations were made in soil and in bare porous cups, duplicate samples in every case being used. Of the total number of tests made only 17 gave a higher percentage of germination in the soil than in the cups. In many cases the germinations were exactly the same in each. As a whole the results of the soil tests averaged slightly lower than those in the germinators. The object of the experiment was to verify by means of soil germinations those made in the germinators, and in this manner arrive at a proper estimation of the value of seed so far as may be determined by its vitality. The results of the experiment are tabulated, showing the usual data of such tests.

Report of the Hamburg seed control station, O. BURCHARD (*Jahresber. Agr. Bot. Vers. Stat. und Samen-Prufungsanstalt zu Hamburg, 1898, VII, pp. 11*).—A report is given of the investigations conducted at the station during the year ending June 30, 1897. The principal lines of investigation reported upon are seed testing, examination of concentrated feeding stuffs, culture experiments with summer wheat, and an inoculation experiment with Nitragin.

The results of 661 tests of seeds to determine their purity, germinative ability, authenticity, and origin are tabulated. As shown in the previous reports, seeds of leguminous forage plants were largely in the majority of all seed tested. Except in the case of red clover seed, 64.5 per cent of the samples of which contained dodder seed, nearly all were free from that parasite. The investigations as to the origin of the clover seed showed a considerable mixture of seed from different countries.

The investigations with Nitragin were made with a mixture of crimson clover and hairy vetch on light sandy soils. Both the seed and soil methods of inoculation were employed and comparisons made with check plats. The plants were cut September 28, and the air-dried fodder from the inoculated plats exceeded that of the checks by 57 per cent, the 2 methods giving the same results. The author investigated the possibility of natural soil infection by sowing a mixture of 20 species of leguminous seed on marsh soil and examined the roots for tubercle formation. Of these the yellow clover and soy bean were without tubercles, the melilotus, esparcet, and kidney vetch contained a few, and red clover, white clover, alsike, the different lupines, serradella, peas, and beans were well inoculated.

Analyses of grass and clover seeds, W. CARRUTHERS (*Jour. Roy. Agr. Soc. England, 3. ser., 8 (1897), pt. IV, pp. 742–744*).—A brief statement is given of the testing of grass and clover seeds during the year. A growing improvement in the purity of seeds is very noticeable. The average purity and germination of a number of grass and clover seeds is given. Of the samples of clover seed examined 10 per cent contained dodder. Samples of alsike clover were free from dodder but frequently contained other mixtures. A brief report is made on grass mixtures, some of which are said to have been of very low grade. Several samples of hay were botanically analyzed and one is reported upon which contained altogether 13 per cent of undesirable weeds. This sample was of such a nature that cows refused to eat it unless salted or chopped and mixed with meal.

Determination of weeds, W. CARRUTHERS (*Jour. Roy. Agr. Soc. England, 3. ser., 8 (1897), pt. IV, pp. 738–742, figs. 5*).—Notes are given on the occurrence of the following weeds: Enchanter's nightshade, mouse-ear chickweed, winter cress, bitter cress, hedge mustard, wild radish, 2 species of clover, parsley piert, wild camomile, pepper saxifrage (*Silaus pratensis*), hawkweed, woolly cudweed, *Pyrethrum inodorum*, comfrey, ground ivy, saffron, *Polygonum bistorta*, and crow or wild garlic.

Notes are given on the injurious qualities of some of these plants when eaten by stock. Enchanter's nightshade is reported as being poisonous, but an examination of the stomach of a cow which was reported to have died from eating this weed revealed the presence of a great many other plants but no trace of this plant. Wild camomile and parsley piert are reported to have caused a peculiar disease of sheep, from which they recovered when placed in a field not containing these plants. Further information is desired relative to the injurious properties of these plants. The pepper saxifrage is said to have caused serious injury, since the butter made from milk of cows pasturing in a meadow where this plant was abundant was unsalable. When the plant was fed to pigs it made them sick. Its strong essential oil is probably the cause of its undesirable character. Meadow saffron and wild garlic are both considered undesirable weeds, the first on account of being an irritant poison and the second because of the strong smell and pungent taste which it gives to milk and butter from cows feeding in pastures where it occurs.

Concerning the valuation of some important agricultural seeds, D. SAKELLARIO (*Wiener Illus. Gart. Ztg., 23 (1898), No. 2, pp. 50–66*).

Seed control, J. E. JACOBSEN (*Ugeskr. Landm., 42 (1897), Nos. 27, pp. 344–348; 33, pp. 431–433*).

Two solanums reputed to be poisonous to stock (*Agr. Gaz. New South Wales, 9 (1898), No. 1, pp. 37, 38*).—Notes are given of *Solanum escuriale* and *S. ellipticum.*

Troublesome or injurious plants, G. HEUZE (*Jour. Agr. Prat., 2 (1897), No. 47, pp. 779, 780*).—Notes are given of *Eruca sativa, Raphanus raphanistrum, Ranunculus sativus, Rumex acetosella,* and *Polygonum aviculare.*

DISEASES OF PLANTS.

Diseases of plants, W. CARRUTHERS (*Jour. Roy. Agr. Soc. England, 3. ser., 8 (1897), pt. IV, pp. 735–738*).—The author briefly discusses a number of diseases of cultivated plants and suggests the best remedies, so far as known, for their prevention. He reports having found timothy attacked by *Spumaria alba* and *Cladosporium herbarum;* and clovers by *Peronospora trifolii*, *Sclerotinia trifolium*, and *Pseudopeziza trifolii.* Among the diseases of cruciferous plants are mentioned attacks of *Plasmodiophora brassica* on various root crops and *Uromyces betæ* as having been found on leaves of mangel-wurzels. An undetermined disease of mangel-wurzels is also noted. It attacks the tuber at its base, involving both the tuber and the smaller roots, and spreading, ultimately destroys the whole plant. There are said to be associated with this disease several species of bacteria.

Several samples of peas which were suffering from attacks of different species of fungi were received. For preventive remedies the author suggests the liberal use of Bordeaux mixture. *Puccinia asparagi* on asparagus is figured and described, and it is recommended that all diseased plants should be cut to the level of the ground and burned.

Two diseases of forest trees are briefly described, caused by *Dasyscypha willkommii* on the larch and *Rosellinia ligniaria* on the ash.

Rust and leopard spot of asparagus, W. G. JOHNSON (*Maryland Sta. Bul. 50, pp. 163–168, pl. 1*).—The author figures and briefly describes two diseases of asparagus which have caused considerable loss to asparagus growers in his State. The asparagus rust is due to *Puccinia asparagi*. The other disease is apparently of fungus origin, although it has not been determined. Cutting and burning over infested fields in midsummer has been resorted to as a method of control, but it is questioned whether such treatment would not prove harmful to the vitality of the plants if continued for several years. Until some better method is discovered this means will perhaps be the one most frequently employed. The use of fungicides, especially when applied in large fields, the author thinks will not offer much help. The character of the soil and method of fertilizing seem to be without any particular effect in securing immunity from the disease.

Recent investigations concerning the leaf spot disease of beets, FRANK (*Ztschr. Ver. Rübenz. Ind., 1897, p. 589; abs. in Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 25–26, pp. 754, 755*).—The fungus causing the characteristic gray spots on the leaves of the beet is said to be *Cercospora beticola*, and while most evident upon the leaves it is not confined to them, but invades the tissues of all the above-ground portions of the plant as well as the roots themselves. The recent investigations of the author indicate that the fungus may be carried over from one crop to another through the seed balls. Soaking them for 24 hours in a weak solution of Bordeaux mixture (2 to 4 per cent solutions), after which they are spread to dry, is recommended as a means for preventing much of the injury from attacks of this disease.

Fairy ring disease of carnations, L. F. KINNEY (*Rhode Island Sta. Rpt. 1896, pp. 203–206, pl. 1, fig. 1*).—An account is given of a disease of carnations which has proved of considerable injury to plants grown under glass during the past season. The Daybreak variety seems to be particularly susceptible to the disease. Attempts have been made with several fungicides to prevent its attacks, but after several weeks' trial all were abandoned except Bordeaux mixture. On account of the discoloration due to Bordeaux mixture it reduces the market value of the plants and should not be used for a considerable time before blooming. The author thinks that the use of fungicides during the summer and the planting only of strong, healthy plants in the house will gradually reduce the amount of disease.

Carnation rust, L. F. KINNEY (*Rhode Island Sta. Rpt. 1896, pp. 207–210, figs. 3*).—Notes are given on the occurrence of carnation rust, and the results of experiments with Bordeaux mixture are reported. The fungicide was used with decidedly beneficial results on a bed of McGowans when the plants were in bloom. The sprayed plants bloomed more freely, but there was no indication that the mixture would completely control the attack. As in the case of the treatment for fairy ring disease the application of Bordeaux mixture should be made early in the season.

Another troublesome disease of carnations is briefly reported upon. It results in the deformity known among growers as "petrified" buds.

It is thought to be due to the too extensive forcing of the plants and consequently can be very easily avoided.

The plum rot and its effect on plum culture in Rhode Island, L. F. KINNEY (*Rhode Island Sta. Rpt. 1896, pp. 191, 192*).—Brief notes are given on the occurrence of black knot, curculio, and the plum rot fungus. The first 2, according to the author, may be more or less successfully combated, but his conclusions relative to the treatment for the prevention of plum rot indicate that the disease can not be controlled by spraying the trees with Bordeaux mixture. It is stated that plum trees heavily sprayed with strong Bordeaux mixture were severely attacked by plum rot. The varying susceptibility of different varieties toward disease is mentioned. This seems to be due in part at least to a difference in the texture of the skin of the fruits, although early varieties are reported as more commonly injured than those which ripen their fruit later. At present it is thought that the Japanese varieties are more resistant than the European, but further discussion of them is deferred.

The root rot of tobacco caused by Thielavia basicola, V. PEGLION (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 21–22, pp. 580–583*).—This disease, which consists of the rotting away of all secondary roots from the main root of the plants, is said to attack some varieties of tobacco more severely than others, Kentucky Burley and to a less extent Seed Leaf being especially susceptible. The rotting away of the secondary rootlets is soon followed by the rapid yellowing of the plant. Adventive roots are put out and the plants sustained for a time, but usually all diseased subjects dry up and perish.

Microscopic examination showed the presence of *Thielavia basicola*, a fungus already known to attack the roots of various cultivated plants, among them *Lupinus luteus*, *L. angustifolius*, *L. albus*, *Trigonella cœrulea*, *Onobrychis crista-galli*, *Pisum sativum*, etc. The relationships of the fungus and its description are given in considerable detail.

Until more is known concerning rational methods of soil disinfection and relative resistance of different varieties, those varieties known to be least liable to disease should be planted.

The periods favorable for treatment against black rot, A. PRUNET (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 22, pp. 889–891*).—The author gives a brief account of experiments made to determine the proper time for spraying grapevines to secure immunity from attacks of the black rot fungus.

In the region where the experiments were conducted it was found that the first important appearance of the disease was noted on May 18. Those vines which had received a single spraying about April 20, when the young shoots are 15 to 20 cm. long, were almost wholly free from disease. Single sprayings made April 12 or 13 were less efficient, and after April 29 were of little effect. Two sprayings, April 20 and May 12, were about equal to the single application at the first date, while spraying on April 28, May 5, 12, and 17 were of no more effect than a single one in preventing attacks of the fungus.

For the later attacks of the disease the author states that a single spraying is sufficient. For the maximum results the application should be made from 2 to 5 days after the most acute period of invasion by the fungus or 5 to 8 days after the appearance of the first spots on the leaves.

As an explanation the author states that at about the dates indicated the young organs of the plant are in a most receptive condition and the spores are at that time being widely disseminated so that the copper solution finds the best conditions for its efficiency.

Studies on root rot and other injuries to ligneous plants, F. CAVARA (*Staz. Sper. Agr. Ital., 29 (1896), pp. 788–814; abs. in Ztschr. Pflanzenkrank., 7 (1897), No. 6, pp. 360, 361*).—Notes are given of the injury to trees through attacks of *Calocera viscosa, Tremellodon gelatinosum, Polyporus versicolor, P. sulphureus, P. cæsius, P. abietinus, Tricholoma saponaceum, Mycena epipterygia, Pleurotus nidulans, Hygrophorus pudorinus, Flammula penetrans, F. spumosa, Pholiota aurivella,* and *Lycoperdon gemmatum.*

Culture experiments with heterœcious rust fungi, H. KLEBAHN (*Ztschr. Pflanzenkrank., 7 (1897), No. 6, pp. 325–345, figs. 4*).—Studies are given of *Melampsora* spp., *Peridermium strobi,* and *P. pini.*

The hexenbesens of cherry trees and their prevention, K. VON TUBEUF (*Prat. Bl. Pflanzenschutz, 1 (1898), No. 1, pp. 4–6, figs. 2*).

Two destructive celery blights, B. M. DUGGAR (*New York Cornell Sta. Rpt. 1897, pp. 201–220, figs. 13*).—A reprint from Bulletin 132 of the station (E. S. R., 9, p. 358).

A disease of currant canes, E. J. DURAND (*New York Cornell Sta. Rpt. 1897, pp. 22–38, figs. 13*).—A reprint of Bulletin 125 of the station (E. S. R., 9, p. 359).

A disease of chestnut trees, E. ROZE (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 23, pp. 982, 983*).—The chestnut is said to be exceptionally subject to attacks of *Pseudocommis vitis,* the cysts or plasmodia of which readily gain entrance through the leaves and young branches. The fruit through its spiny envelope also offers a good medium for attacks of the organism and the attack on the fruit is often associated with *Aspergillus glaucus.*

A new disease of firs, F. CAVARA (*Ztschr. Pflanzenkrank., 7 (1897), No. 6, pp. 321–325, pl. 1*).—Notes are given of attacks of *Cucurbitaria pithyophila cembræ* on *Abies pectinata.* From the nature of the disease the affected portions should be cut away and burned.

On the development of the white rot of grapes (Charrinia diplodiella), P. VIALA (*Ann. École Nat. Agr. Montpellier, 9 (1895–'96), pp. 266–268*).

The lily disease, B. D. HALSTED (*Amer. Florist, 13 (1898), No. 510, p. 882, fig. 1*).—Briefly describes the Bermuda lily disease, quoting from U. S. Dept. Agr., Division of Vegetable Physiology and Pathology Bulletin 14 (E. S. R., 9, p. 658).

Diseases of the potato, E. G. LODEMAN (*New York Cornell Sta. Rpt. 1896, pp. 295–331, pl. 1, figs. 2*).—A reprint of Bulletin 113 of the station (E. S. R., 8, p. 137).

Rust experiments, F. MADDOX (*Agr. Expts. Eastfield, Tasmania, 1897, pp. 85–90*).—The author gives a review of experiments conducted with different rusts in which various facts relative to the life history of the fungus were investigated, and he concludes that their life history is by no means understood.

Latest experiences concerning rust on small grains, E. ROSTRUP (*Ugeskr. Landm., 43 (1897), No. 48, pp. 637–639*).

What is grain rust and how can it be checked? J. ERIKSSON (*Hvad är Sädesrost och hvad kan göras mot densamma? Stockholm: P. A. Norstedt & Söner, 1896, pp. 82*).

Does it pay to spray? (*Ontario Dept. Agr. Special Bul., 1897, Dec., pp. 8*).—A report is given of the results obtained in spraying 29 orchards in different parts of the Province of Ontario in which the benefits derived from the application of Bordeaux mixture in reducing the amount of apple scab and other diseases was plainly shown. Brief letters are given from the owners of the different orchards in which are stated their opinions relative to the success and the value of the treatment.

Spray calendar, E. G. LODEMAN (*New York Cornell Sta. Rpt. 1896, pp. 335–343, figs. 4*).—A reprint of Bulletin 114 of the station (E. S. R., 8, p. 149).

The effect of spraying Bordeaux mixture on foliage, F. C. HARRISON (*Canad. Hort., 21 (1898), No. 3, pp. 99–101*).

Experiments for the prevention of Botrytis cinerea on grapes, J. BURNAT (*Prog. Agr. et Vit., 28 (1897), No. 47, pp. 591–593*).—Reports successful experiments with a powder composed of cement, steatite, and hydraulic lime, in the proportion of 2, 3, and 5 parts.

Experiments with fungicides for the prevention of grape anthracnose, G. GOUIRAND and G. BERGERON (*Rev. Vit., 7 (1897), No. 159, p. 5; abs. in Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 21–22, pp. 603, 604*).—Experiments were conducted with solutions of copper sulphate, iron sulphate, and sulphuric acid for the prevention of grape anthracnose due to *Sphaceloma ampelinum*. Ten per cent solutions of sulphuric acid gave good results when applied to the vines early in the spring. Similar results were secured with the iron sulphate. The use of copper sulphate was not so successful.

Results of experiments in 1896 to combat grape mildew, G. CUBONI (*Bol. Not. Agr., 19 (1897), pp. 401–411; abs. in Ztschr. Pflanzenkrank., 7 (1897), No. 6, pp. 355, 356*).—A number of fungicides were tested for the prevention of grape Peronospora, comparisons being made with Bordeaux mixture.

Copper acetate was found inferior to Bordeaux mixture. A copper-soda mixture, while about as efficient as Bordeaux mixture, was more expensive. Copper sulphosteatite, boral, and Statuti's mixture proved worthless.

A new grape parasite, L. MONTEMARTINI (*Atti. Istit. Bot. Univ. Pavia, 1897; abs. in Ztschr. Pflanzenkrank., 7 (1897), No. 6, pp. 359, 360*).—Under the name *Aureobasidium vitis album* the author describes a new variety of this micromycete, which is parasitic on the grapevine.

ENTOMOLOGY.

Brood XV of Cicada septendecem in Ohio, F. M. WEBSTER (*Canad. Ent., 29 (1897), No. 10, pp. 225–229, figs. 3*).—In this paper, which was read before Section F of the American Association for the Advancement of Science at its Detroit meeting, August 10, 1897, the author gives an account of his study of Brood XV of the 17-year locust. It was found to occupy the whole of the eastern half of the State of Ohio with the exception of a strip along the lake region and the northeastern counties of Ashtabula and Trumbull, and the eastern portion of Mahoning and Columbiana and most of Lawrence and Galla counties in the southern part of the State. The brood appeared to be less in numbers than formerly, and it is thought to be on the decline, so that in time it will be known only in history. The later appearing members of the brood were attacked severely by a tachina fly, but the greatest enemies of the locusts seem to be various birds, such as the English sparrow, crow blackbird, and robin. The first of these seemed to be exceedingly fond of them, since they paid no attention to *Pieris rapæ* and some other butterflies of the neighborhood.

A report of the entomological department, A. D. HOPKINS (*West Virginia Sta. Rpt. 1896, pp. 66–164, figs. 2, pls. 4, maps 3*).—In the first part the author reviews his work from 1890 to 1896, describes his various collections, and gives a bibliography of his original researches. Forest entomology was dealt with especially. The importation of the European bark beetle destroyer (*Clerus formicarius*) is noted as successful. The defects in wood produced by insects were studied. The destructive heartwood borer (*Centrodera decolorata*), along with the chestnut timber worm (*Corthylus columbianus*), was found in living trees where fires and other agencies had broken the bark sufficiently to expose the wood. The latter of these 2 insects was found in oak, tulip, and other kinds of wood, in which it produced what are known as black hole stains, ribbon or calico wood. A parasite (*Aphidius lactucæ*) was experimented with in the greenhouse, where it kept its host (*Aphis brassicæ*) so subdued that no other remedies were needed. The remainder of this part deals with incidental matter.

The principal insect depredations and depredators noted in the State during the past 5 years (pp. 93–110).—In this second part the author reports briefly the results of studies of dying pine, spruce, yellow locust, hemlock, and oak; the defoliation of forest trees, shade, and fruit trees; tan bark destroyed by insects (*Phymatodes variabilis*); wormy chestnuts and hickory nuts; the bag worm (*Thyridopterix ephemeræformis*); the elm leaf beetle (*Galerucella luteola*); and the common farm and garden insects and fruit insects. Among the last the imported fruit bark beetle (*Scolytus rugulosus*) is noted. The San José scale is mentioned as reported from 2 counties.

The remainder of this part deals briefly with the common insects affecting live stock and the common household insects.

A study of agricultural conditions in West Virginia and the needs of entomological work (pp. 111–164).—Here are discussed in a very general way geographical, geological, and climatic conditions, life zones, forest areas of the State, designated as spruce, pine, and hard-wood areas, and the relation of forest divisions to life zones.

Finally there is a paper on some discoveries and observations made during 1894 and 1895, in which the borer *Agrilus bilineatus*, the habits of *Corthylus punctatissimus*, and *Agrilus* sp., the elm and pine borer (*Gortyna nitela*, *Cyllene picta*, *Corthylus columbianus*), and a number of other more or less common insects are noted. *Cyllene picta*, it is shown, emerges in the fall. Woodpeckers are mentioned as causing considerable loss of timber. *Epidapus scabies* (=*E. scabiei*) is noted as attacking potato tubers, causing potato scab. It is said that the presence of stable manure and moisture is a very important factor favoring the development of the insects.

This and the remaining papers—some observations on the gall mite, some notes on insect enemies of trees, and on farm, garden, and fruit insects—are reprints of articles that have appeared elsewhere.

The immature stages of Diabrotica soror, R. W. DOANE (*Jour. Ent. Soc., 5 (1897), No. 1, pp. 15–17*).—The hitherto unknown history of this insect has been studied.

The oval, dirty white egg measures 0.7 by 0.5 mm. and has a finely sculptured surface, due to the hexagonal areas formed by the follicular cells. The full-grown larva measures 12 mm. in length and tapers slightly toward the head. The general color is white, often turning yellowish near the time of pupation. The head, dorsal shield, and the last abdominal segment are brown. There is but a single pair of fleshy prolegs. Near the posterior end are several strong marginal hairs and 2 subtriangular processes.

The pupa is whitish or straw-colored and measures 4 by 2 mm. and is provided with brown hairs more or less definitely arranged. The eggs are deposited from $\frac{1}{4}$ to $\frac{1}{2}$ in. below the surface of the ground near the base of some plant. Usually from 20 to 50 are laid in one spot, but sometimes only one. The larvæ develop slowly, for they were found in various sizes on the roots of plants in March, April, and May. The roots are eaten on the outside and are not bored into. The range of food plants is wide. Larvæ are often found in abundance on roots of sweet peas and alfalfa. The adults often give fruit growers considerable trouble by eating young fruit.

The number of molts in insects of different orders, A. S. PACKARD (*Psyche, 1897, No. 258, pp. 124–126*).—The number of molts varies with the latitude, temperature, and other conditions. Semi-starvation and consequent prolongation of life seems to favor an increase in the number. Some species molt once more in the southern than in the northern United States. In Campodia there is a single fragmentary molt, according to Grassi, and in Collembola (*Macrotoma plumbea*), according to Sommer, the skin is shed throughout life. Hibernating larvæ molt oftener than summer broods. Among Orthoptera the number of molts varies from 2 (*Diapheromera femorata*) to 7 (*Mantes religiosa* and *Periplaneta americana*). Among Homoptera there are from 2 to 4 molts. In the May fly (Chelon) there are 20 molts. In the neuropterous *Ascalaphus insimulans* of Ceylon there are 3. Plecaptera (Panorpa) molt 7 times; in Coleoptera the number varies so far as known from 3 (*Phytonomus punctatus*) to more than 15 (*Trogoderma tarsale*). Siphonaptera molt 3 times. In Lepidoptera the average number of molts is 4, the greatest number known being 11 (*Phyoractia isabella*). Among the Diptera there are from 2 (Calliphora) to 11 (*Harpiphorus varianus*). In the Hymenoptera (*Aphis mellifica*) there are, according to Chesshire, probably 6 molts.

Monograph of the genus Aspidiotus, G. LEONARDI (*Riv. Pat. Veg., 5 (1896–'97), No. 9–12, pp. 283–286*).—In this, a preliminary note, Leonardi proposes the new genera of the Aspidioti, Odonaspis, Chentraspis, and Phanlaspis and arranges the numerous species of the 9 genera of the group as follows: A. *Aspidiotus nerii, juglans-regiæ, pini,* *spinosus*, *pativinus*, *abietis*, and *theæ;* B. *Aspidiotus sacchari*, *hartii*, *zonatus*, *maculatus;* C. *Aspidiotus ancylus*, *uvæ*, *cydoniæ;* D. *Aspidiotus articulatus; Aonidia lauri* and *cornigera; Aspidites camelliæ* and *minimus; Chrysomphalus ficus*, *spheriodes*, *magniferæ*, *nigropunctatus*, *dictiospermæ*, *obscurus*, *perseæ*, *rossi*, *minor*, and *degeneratus*; *Targionia nigra*, *vitis*, and *prospoidis; Aonidiella aurantii*, *fusca*, *perniciosa*, *tenebricosa*, *mimosæ*, *personata*, and *smilacis; Odonaspis secreta*; *Chentraspis extensa* and *unilobis;* and *Phaulaspis hakeæ.*

The army worm in Rhode Island, C. O. FLAGG AND G. W. FIELD (*Rhode Island Sta. Rpt. 1896, pp, 319–326, fig. 1*).—Twenty-eight replies received in response to a circular showed that the army worm was present and doing more or less damage in 5 counties. The crops reported damaged were oats in 9 cases, barley 5, Hungarian grass 4, corn 3, and grass 2. Hungarian grass sown late was reported as entirely destroyed. A brief account of the life history of the insect is given and the following destructive agencies noted: Robin, bluebird, blackbird, bobolink, meadow lark, pigeon woodpecker (*Colaptes auratus*), a black predaceous ground beetle, Tachina and Ichneumon flies, spiders' webs, electric lights, and a large ground spider (*Epeira*) that feeds on caterpillars. It is also noted that the insects seemed to be attacked by an infectious disease that carried them off in great numbers. To these natural checks the rapid disappearance of the pest is attributed.

The preventive measure noted is the ordinary one of furrowing and the use of lines of tar.

The army worm in New York, M. V. SLINGERLAND (*New York Cornell Sta. Rpt. 1897, pp. 233–258, pls. 2, figs. 3*).—A reprint of Bulletin 133 of the station (E. S. R., 9, p. 365).

Some of the injurious insects of Pennsylvania, C. W. JOHNSON (*Pennsylvania Dept. Agr. Rpt. 1896, pp. 345–373, pls. 2*).—The paper notes the San José scale (*Aspidiotus perniciosus*), the cotton maple scale (*Pulvinaria innumerabilis*), the rose scale (*Diaspis rosæ*), the bag or basket worm (*Thyridopteryx ephemeræformis*), the white marked tussock moth (*Notolophus* [*Orgyia*] *leucostigma*), the oak carpenter worm or borer (*Prionoxystus robiniæ*), locust borer (*Cyllene robiniæ*), the broad necked prionus (*Prionus laticollis*), stag beetles (*Lucanus dama*), May beetles (*Lachnosterna* spp.), rose beetle (*Macrodactylus subspinosus*), asparagus beetle (*Crioceris asparagi*), the new asparagus beetle (*Crioceris 12-punctata*), the fruit bark beetle (*Scolytus rugulosus*), the hickory bark borer (*Scolytus 4-spinosus*), the pine bark beetle (*Tomicus cacographus*), the potato stalk borer (*Trichobaris trinotata*), the thick thighed walking stick (*Diapheromera femorata*), as well as the remedies against each.

A chapter is given on the subject of sparing the insectivorous birds, and on imprisoning and fining the snarer.

Contributions from the New Mexico Biological Station No. 2 on a collection of Diptera from the lowlands of the Rio Nantla in the State of Vera Cruz, II, C. H. T. TOWNSEND (*Ann. Mag. Nat. His., 6. ser., 20 (1897), 117, pp. 172–291*).—This paper takes up the Trichopoda, some 22 species and varieties of which are tabularly distinguished, and the new varieties, *T. histrio indivisa* and *T. lanipes tropicalis* and the new species *T. phasiana* described. The last is distinguished by its wings, being black only on the costal third, and by its black abdomen with two basal yellow spots.

Pennapoda is described as a new subgenus which is distinguished by the abdomen being nearly of the same shape in both sexes, rounded at the tip and narrowed slightly at the base. It is connected with Trichopoda proper by the forms of *T. histrio.*

A new variety of *Lipoptena depressa* of the Hippoboscidæ, namely, *L. mexicana*, is also described. *L. depressa* breeds at times and probably always on deer, and the author thinks it is always wingless.

On the systematic position of the hemipterous genus Phimophorus, A. HANDLIRSCH (*Verhandl. K. K. Zool. Bot. Gesell. Wien, 47 (1897), No. 8, pp. 558–560, figs. 2*).

The larva of Crocota opella, H. G. DYAR (*Psyche, 8 (1897), No. 257, p. 119*).—The egg, the three larval stages, and the cocoon are described. The eggs are laid at the end of July and the half-grown larvæ hibernate during the next winter. The eggs are deposited in patches on the leaves of bushes and trees, but the larvæ drop to the ground on hatching. Almost any tender leaves are eaten.

Bramble stalks and their inhabitants, RUDOW (*Illus. Wchnschr. Ent., 2 (1897), Nos. 14, pp. 209–213, figs. 20; 15, pp. 235–238*).—The habits of *Diastrophus rubi, Torymus macropterus, Proctotrupes, Synopeas, Lasioptera rubi, Diastrophus turgidus, D. nebulosus, D. cuscutiformis, Cecidomyia conifica, C. cornifex, C. tumifica*, etc., are described.

On Plusia moneta, PABST (*Illus. Ztschr. Ent., 2 (1897), No. 44, pp. 695–697*).—Observations on the food plants and the life history. The species occurs on several species of Aconitum and Delphinium. On the first the young larvæ attack first the terminal leaves, while on Delphinium they attack the leaves anywhere.

Bombyx neustria, C. SCHROEDER (*Illus. Ztschr. Ent., 2 (1897), No. 43, pp. 673–678, figs 4*).—The ravages of this moth on *Prunus spinosa* and *Pyrus malus* are figured and the habits of the insect and its food plants discussed.

Aphidological contributions, N. CHOLODKOVSKY (*Zool. Anz., 1896, No. 520, pp. 508–513; rev. in Zool. Centbl., 4 (1897), No. 26, pp. 918, 919*).—The elm leaf louse (*Schizoneura ulmi*) is thought to have but one gall generation. *Colopha compressa* of Koch is regarded as identical with the American *Colopha ulmicola.* The intermediate generation of *C. compressa* was found on the roots of *Aira cæspitosa.* Other aphids noted are *Lachnus hyalinus, L. piccicola, L. pineus, L. tæniatus, L. bogdonowi, L. juniperi, L. nudus, L. farinosus, L. pineti, L. agilis, Schizoneura fodiens*, and *Chermes abietis.*

On some Phasmia forms, E. GIRSCHNER (*Illus. Wchnschr. Ent., 2 (1897), No. 3, pp. 33–36, figs. 7*).—*Phasmia magnifica*, n. sp., is described.

Two notable aberrations in Vanessa antiopa and a new method of producing aberrations by cold, E. FISCHER (*Illus. Wchnschr Ent., 2 (1897), No. 11, pp. 161–167*).—Cold was obtained with sulphuric ether and the pupæ were subjected to -2° C. for 5 minutes and then removed to the temperature of the room, 20° C. Out of 24 pupæ 15 abnormal forms were obtained.

Mamestra pisi, C. SCHROEDER (*Illus. Wchnschr. Ent., 2 (1897), No. 12, pp. 177, 178, pl. 1*).—The larvæ of this moth is shown to very closely resemble *Helix nemoralis* when it is coiled up.

The influence of water on the life of larvæ, H. GAUCKLER (*Illus. Wchnschr. Ent., 2 (1897), No. 19, pp. 295, 296*).—The author concludes that those larvæ that seek sunlight may be injured by dampness and those that live in moist situations may be injured by light, etc.

Notes on the transformations of higher Hymenoptera, III, A. S. PACKARD (*Jour. New York Ent. Soc., 5 (1897), No. 3, pp. 109–120, figs. 5*).—Descriptions of the larvæ and pupæ of *Aphis mellifica, Bombus separatus, B. vagans, Anthrax sinuosa, Xylocopa virginica, Ceratina dupla*, and *Megachile centuncularis.*

The compound eyes of Ephemeridæ, C. ZIMMER (*Ztschr. Wiss. Zool., 63 (1897), No. 2, pp. 236–262, pls. 2*).—After a minute study of the eyes of *Cloë fuscata* and other Ephemerids the author concludes that such divided eyes as are found in this form are not uncommon among insects and that their function seems to be the same. This division of the eye into two more or less distinct parts is found where the conditions of life render it necessary to recognize motion, especially the motion of the female.

The glandular hairs of the larva of the Nonne, J. INGENITZKY (*Horæ Soc. Ent. Ross. [St. Petersburg], 30 (1896), pp. 130–136, pl. 1; abs. in Zool. Centbl., 4 (1897), No. 25, pp. 874, 875*).—The author studied the hairs and cells beneath them in *Ocneria dispar, O. monacha*, and *Cnethocampa processionea.* The bladder hairs (aërophore), discovered by Wachtl and Kornauth in the young larvæ, the author finds to be lost at the first molt and succeeded by ordinary hairs. Beneath the hairs he finds two kinds of hypodermis cells, one with branching nuclei and forming monocellular glands, and a cell without a branching nucleus that becomes greatly developed during molting, and further small cells that form the chitinous collars of the hairs. The trichogen cells described by A. S. Packard the author considers glandular cells and the poison cells as hypodermal cells and collar cells.

Some remarks on the developmental states of the leaf wasps, RUDOW (*Illus. Wchnschr. Ent., 2 (1897), No. 17, pp. 263–266, figs. 14*).—The galls produced by *Trichiosoma sorbi, Abia fasciata, A. sericea*, etc., are described.

Descriptions of new cynipidous galls and gall wasps in the United States National Museum, W. H. ASHMEAD (*Proc. U. S. Nat. Mus., 19 (1897), pp. 113–136*).—A new genus, Compsodryoxenus, and 43 new species are described.

Dichelomyia galls, C. SCHROEDER (*Illus. Wchnschr. Ent., 2 (1897), No. 22, pp. 339–345, figs. 6*).—The form of the galls and the leaf deformations produced by flies of this group are described and figured.

Some notable gall formations, RUDOW (*Illus. Ztschr. Ent., 2 (1897), No. 41, pp. 645–649*).—The formation and the form of galls produced by plant lice on Populus and some other trees are described.

Three interesting Staphylinidæ from Queen Charlotte Islands, J. H. KEEN (*Canad. Ent., 29 (1897), No. 12, pp. 285–287, figs. 3*).—*Liparocephalus brevipennis* and *Tanyrhinus singularis* are discussed.

The life history of Epeiranthis obfirmaria, T. W. FILES (*Canad. Ent., 29 (1897), No. 11, pp. 258, 259*).—The adult, eggs, and larva are described. The larvæ fed on Vaccinium, Cassandra, etc.

Notes on the life history of Colias interior, H. H. LYMAN (*Canad. Ent., 29 (1897), No. 11, pp. 249–258*).—The egg, the larva in its various stages, the chrysalis, the pupa, and the adults are described.

Notes on Grapta interrogationis, H. H. LYMAN and A. A. WINN (*Canad. Ent., 29 (1897), No. 12, pp. 273–277*).—This is a collection of miscellaneous notes on the life history, etc., of this insect. It is thought that the third brood must certainly hibernate.

A new food plant for Papilio asterias, G. H. FRENCH (*Canad. Ent., 29 (1897), No. 11, pp. 263, 264*).—*Ruta gravolens* and *Fœniculum officinale.*

The agrarian Acari, A. BERLESE (*Riv. Patol. Veg., 6, No. 1–5, pp. 1–66, figs. 40, pls. 4*).—This is a portion of a monograph on the subject. This part of it is occupied with a description of the anatomical features, the terminology, and the habits of the agrarian mites, and the influence of surrounding conditions upon them. Considerable space is also given to a discussion of their means of offense and defense. The means of defense the author classes as epidermal projections of the integument, citing as example *Leiosoma palmicinetium* and *Tegeocranus cepheiformis;* peculiar secretions, such as are found in the Tyroglyphidæ; peculiar capsules constructed by the mites, and protective coloration.

Life history of Pyromorpha dimediata, H. G. DYAR (*Psyche, No. 258, Apr., pp. 128, 129*).—The peculiar habit of the larvæ of this insect has hitherto prevented its detection, but the author has found it below fallen leaves in oak woods. The period from egg to pupa state is stated to be 3 months, or from June 15 to September 15. The pupal stage passes the winter. The colorization is dark, so as to harmonize with the surroundings. The egg and 6 larval stages and the pupæ are described somewhat in detail.

New species of Chionaspis, R. A. COOLEY (*Canad. Ent., 29 (1897), No. 12, pp. 278–282*).—*Chionaspis cockerelli* taken from palm imported from China to San Francisco, *C. aucubæ* imported on aucuba from Japan, *C. wistariæ* found on bark of wistaria from Japan, *C. pinifoliæ heterophyllæ* found on Cuban palm (*Pinus heterophyllæ*) from Florida, and *C. latissima* taken from the under side of the leaves of *Distylium racemosum* from Japan.

On the generic position of some bees hitherto referred to Panurgus and Calliopsis, T. D. A. COCKERELL (*Canad. Ent., 29 (1897), No. 12, pp. 287–290*).—The new genus Pseudopanurgus and the new species *Halictoides campanulæ* are described. The distinctive features of the several genera discussed are briefly brought out in tabular form.

A complete course in apiculture, G. DE LAYENS and G. BONNIER (*Cours complet d'apiculture. Paris: Paul Dupont, n. d., pp. 439, figs. 243*).—This is a treatise briefly covering nearly all the questions to which the amateur apiculturist may desire an answer.

How to render small amounts of wax, E. I. ABBOTT (*Amer. Bee Jour., 37 (1897), 36, pp. 564, 565*).

Economic entomology, J. H. PANTON (*Ontario Dept. Agr. Rpt. 1896, pp. 168–200, figs. 86*).—Report of the superintendent of Farmers' Institutes of the Province of Ontario, 1896–'97. This gives the estimate of the damages done by injurious insects in several of the States and in Canada for the years 1854–'84, and forms a brief popular treatise on the subject of economic entomology.

The pear psylla and the New York plum scale, M. V. SLINGERLAND (*New York Cornell Sta. Rpt. 1896, pp. 105–122*).—A reprint of Bulletin 108 of the station (E. S. R., 8, p. 142).

Wireworms and the bud moth, M. V. SLINGERLAND (*New York Cornell Sta. Rpt. 1896, pp. 71–101, figs. 24*).—A reprint of Bulletin 107 of the station (E. S. R., 8, p. 143).

The currant stem girdler and the raspberry cane maggot, M. V. SLINGERLAND (*New York Cornell Sta. Rpt. 1897, pp. 41–60, pls. 3, figs. 5*).—A reprint of Bulletin 126 of the station (E. S. R., 9, p. 363).

Green fruit worms, M. V. SLINGERLAND (*New York Cornell Sta. Rpt. 1896, pp. 569–583, pls. 4*).—A reprint of Bulletin 123 of the station (E. S. R., 8, p. 802).

The San José scale in Pennsylvania, G. G. GROFF (*Pennsylvania Dept. Agr. Rpt. 1896, pp. 514–531, pls. 2*).—This is mostly a popular compilation from different sources and contains a synopsis of the State laws against the San José scale.

The pistol case bearer in western New York, M. V. SLINGERLAND (*New York Cornell Sta. Rpt. 1897, pp. 17, pls. 2, fig. 1*).—A reprint of Bulletin 124 of the station (E. S. R., 9, p. 367).

Bee paralysis carried by the queen, E. GALLUP (*Amer. Bee Jour., 37 (1897), No. 31, p. 481*).—It is stated that bees from a purchased queen were found dead in large numbers in front of their hive and that a young queen from the same mother was seen to die in an observation hive. The disease would thus appear to be hereditary. It was gotten rid of by introducing healthy queens from healthy colonies.

Propagation of the maladies of the silkworm by birds, F. LAMBERT (*Rev. Vit., 1897, No. 168, pp. 269, 270; abs. in Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No. 22–23, p. 895*).

A new type of organism parasitic on Gregorines, M. CAULLERY and F. MESNIL (*Compt. Rend. Acad. Sci. Paris, 125 (1887), No. 20, pp. 787–790, figs. 10*).—There is here described under the new generic and specific name of *Metchnikovella spionis* a peculiar organism probably of parasitic nature found in the *Gregorina spionis* of the alimentary canal of the annalid *Spio martinensis.* The organisms appear as nucleated rounded bodies. They multiply by fission and by gemmation and exist in the body of the gregorin in the form of chains or singly in elongated vacuoles. The bodies measure about $2\frac{1}{2}\ \mu$ in size and are usually arranged in 2 rows of about 16 each. In the gregorine (*G. anchorina*) of the capitellid, *Capitellides giardi*, a similar organism is found. Similar bodies have been described and figured from the gregorines of other worms, but hitherto they have not been explained.

FOODS—ANIMAL PRODUCTION.

A study of alfalfa and some other hays, W. P. HEADDEN (*Colorado Sta. Bul. 39, pp. 34*).—In continuation of previous work (E. S. R., 8, p. 768) the author reports analyses of a number of samples of alfalfa hay of the first, second, and third cuttings. In each case samples were taken of plants coming in bloom, in half bloom, and full bloom. The average results of the analyses were as follows:

Composition of alfalfa.[1]

	Water.	Protein.	Fat.	Nitrogen-free extract.	Fiber.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
First cutting	7.17	15.12	1.24	30.98	34.73	10.76
Second cutting	7.49	17.08	1.66	36.17	26.28	11.32
Third cutting	8.14	15.88	1.69	34.62	28.34	11.32

[1] Air-dried hay.

The results of analyses made in different years at the Colorado and Utah stations are compared.

To learn whether there was any foundation for the popular belief that hay which has been stored for from 1 to 9 months in a mow or stack is preferable to older hay, a number of air-dried samples of alfalfa hay were kept for 1 to 2 years in glass stoppered bottles sealed with parafin. The bottles were kept in the dark. In nearly every case it was found that at the end of the time the moisture and nitrogen content of the different samples had increased, though in no case was the increase regular.

"Our experiments indicate that there is no loss of the protein, but that chemical changes take place to a considerable extent in some of the other constituents, probably in those complex and less stable compounds grouped under the head of nitrogen-free extract and frequently spoken of as carbohydrates. The apparent increase of nitrogen is easily accounted for by the elimination of water and probably of other compounds also, as oxids or hydrids of carbon."

Artificial digestion experiments are reported with alfalfa hay of different cuttings kept for different lengths of time.

The coefficients of digestibility of the protein of different cuttings were as follows:

"For 1894, first cutting, 79.43; second cutting, 80.62; third cutting, 82.69; for 1895, first cutting, 80.64; for 1896, first cutting, 80.14; second cutting, 78.81; third cutting, 78.85. The average for all the cuttings made in the three years is 79.79, which is in excellent agreement with the results obtained by animal digestion.

"The results taken by years are as follows: For 1894, hay two years old, 80.91; for 1895, hay one year old, 80.64; for 1896, new hay, 79.27, from which it is clearly apparent that the proteids have not lost any of their digestibility, and from this standpoint hay which is one, or even two years old, is quite as good as new hay."

The amount of pentosans, expressed in terms of xylan, was determined in a number of samples of alfalfa hay. The results were not entirely concordant. They indicate, in the author's opinion, that—

"There are several complexes present which yield furfurol, and offer different degrees of resistance to the alternate action of acids and alkalies. The complexes yielding more readily to the action of these agents predominate in the leaves, forming nearly nine-tenths of the whole amount, whereas in the stems they form only about one-half."

Proximate analyses are reported of hay from *Stipa viridula* var. *robusta*, hay from pea vines cut in full bloom and full pod, and upland hay. The composition of the hay from *Stipa viridula* was as follows: Water 5.53 per cent, protein 8.91, fat 1.96, nitrogen-free extract 38.24, fiber 39.60, and ash 5.76. Although ordinary analysis would indicate that this hay possesses a high feeding value as compared with other hay, it is known to be of little value, since cattle will eat it only when compelled by hunger.

In order to learn something more definite of the real value of hay of different sorts analyses more detailed than those ordinarily reported were made of alfalfa hay, clover hay, pea-vine hay, and upland hay. The composition of these hays is shown in the following table:

Composition of different kinds of hay.

	Alfalfa hay coming in bloom.	Clover-hay heads, half turned.	Pea-vine hay in full bloom.	Pea-vine hay in full pod.	Upland hay.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Invert sugar	0.00	1.33	0.00	0.00	0.00
Cane sugar	Trace.	.21	.00	3.05	.98
Dextrin	Trace.	4.03	.74	.71	.00
Starch	1.11	.76	.00	2.53	.40
Xylan, by acid	3.76	4.03	3.16	7.24	1.77
Xylan, by alkali	.15	.72	.82	.66	.79
Lignones	6.66	4.99	6.47	10.30	3.12
Cellulose	25.59	18.70	18.65	18.20	27.93
Soluble in alcohol, sugar, etc., deducted	13.87	29.59	28.35	25.84	19.75
Soluble in water, dextrin, etc., deducted	11.88				
Moisture	7.21	5.36	5.87	6.03	3.05
Ash	9.81	10.17	11.27	7.14	7.89
Ether extract	1.15	1.88	3.20	1.84	2.22
Proteids	15.16	13.43	20.20	16.58	6.13
Not determined	3.65	4.80	1.25	.00	35.97
	100.00	100.00	100.00	100.10	100.00
Coefficient of digestion for protein[1]	79.15	76.43	84.71	81.61	45.77

[1] Determined by artificial digestion.

The composition of the ash of pea vines in full bloom and in full pod and of alfalfa in full bloom was also determined and is shown below:

Composition of ash of pea vines and alfalfa.

	Pea vines in full bloom.	Pea vines in full pod.	Alfalfa in full bloom.
	Per cent.	*Per cent.*	*Per cent.*
Carbon	Trace.	Trace.	0.112
Sand	5.033	4.524	.829
Silicic acid	2.620	3.293	.881
Phosphoric acid	6.726	7.070	5.234
Sulphuric acid	4.767	2.620	5.608
Carbon dioxid	18.325	21.455	23.730
Chlorin	6.231	3.765	8.500
Calcium oxid	11.614	16.650	27.620
Magnesium oxid	3.669	4.192	3.798
Ferric oxid	.659	.560	.269
Aluminic oxid	.366	.548	.089
Manganic oxid (brown)	.262	.560	.168
Potassium oxid	36.164	30.917	24.240
Sodium oxid	1.366	3.629	.943
Moisture	Not det'd.	.856	.000
Sum	100.802	100.939	102.021
Less oxygen, equivalent to chlorin	1.188	.855	1.920
Total	99.614	100.084	100.101

The author sums up his work with hay as follows:

"(1) The composition of alfalfa hay grown under the same climatic conditions does not vary from year to year more than samples of the same year, which is within fairly narrow limits.

"(2) Climatic or seasonal differences do affect the composition of the hay. This, however, affects the different cuttings of the same year rather than the crops for a whole year, but this effect is comparatively small and expresses itself most pronouncedly in the percentage of crude fiber.

"(3) The amount of the protein in alfalfa hay does not decrease with but rather increases with age, if the hay is kept in a close mow.

"(4) The changes in the hay probably affect the amount and character of the nitrogen-free extract.

"(5) The protein of the different cuttings is about equally digestible, as determined by means of pepsin-hydrochloric acid. There is, however, a slight difference in favor of the hay cut when the plants were in full bloom.

"(6) The digestibility of the protein does not vary materially from year to year, nor is it affected by the age of the hay if well kept.

"(7) The lignocelluloses in alfalfa increase with the age of the plant, but there are exceptions which can not be justly attributed to methods of determination.

"(8) The presence and amount of sugar, starch, etc., depend upon the development of the plant at the time of cutting, and is at all times comparatively small.

"(9) The lignocelluloses are more abundant in the leguminous hays than in those made from our native grasses, but the cellulose is much more abundant in the latter.

"(10) The soluble portion of leguminous hay is greater than that of the little hay made from the grasses, which accounts for their susceptibility to weathering."

Feeding tests with barley, W. W. COOKE (*Colorado Sta. Bul. 40, pp. 15–40*).—Experiments are reported with pigs, steers, and sheep to compare barley with wheat and corn, barley fed alone and with corn, and bald barley with common barley and with corn; and to learn the value of grinding common and bald barley. The feeding stuffs used in the experiments were analyzed. The composition of bald barley and common barley was as follows:

Composition of barley.

	Water.	Protein.	Fat.	Nitrogen-free extract.	Fiber.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Common barley	10.09	8.66	2.47	73.82	3.09	1.87
Bald barley	9.44	13.21	2.69	68.55	2.77	3.34

The author quotes the digestibility of the different feeding stuffs, and assumes that bald barley would have the same digestibility as wheat.

Experiments with pigs (pp. 18–28).—In 1894 a test was made with 2 lots of 6 and 5 pigs, respectively. Lot 1 was fed common ground barley *ad libitum* and lot 2 corn *ad libitum.* In 1895 the test was repeated with smaller and younger pigs. The results are briefly reported.

In 1896–97 a test was made with 44 pigs divided into 9 lots. The lots were fed corn, bald barley, and common barley (whole and ground), with and without skim milk. The test was continued for about 6 weeks. The lots were rearranged during the test, so as to make the comparison as nearly equal as possible. The average results are shown in the following table:

Results of pig-feeding experiments, 1896–97.

Foods used.	Number of trials.	Average weight of pigs at beginning of test.	Average daily gain.	Average daily feed.		Food consumed per pound of gain.	
				Grain.	Skim milk.	Grain.	Skim milk.
		Pounds.	*Pound.*	*Pounds.*	*Quarts.*	*Pounds.*	*Quarts.*
Whole corn	6	71	0.39	2.0	0.7	7.0	1.1
Ground corn	5	60	.46	2.4	1.0	5.4	1.1
Whole bald barley	8	88	.58	2.3	1.2	5.0	1.3
Ground bald barley	5	67	.74	2.4	.8	3.6	.8
Whole common barley	4	68	.49	2.3	.5	5.4	.7
Ground common barley	4	47	.70	2.4	1.1	4.3	1.1
Ground corn and barley	4	50	.77	2.1	1.0	4.1	.8

The following conclusions were drawn: Grinding increased the value of bald barley one-half, common barley one-twelfth, and corn one-fifth. The most rapid gains were made with ground bald barley. Ground corn and ground common barley had about the same feeding value, the barley being slightly superior. A pound of gain required one-half more ground corn than ground barley, and one-third more ground common barley than ground bald barley. Ground common barley and ground corn fed together gave better results than the same grains fed separately.

Feeding experiments with steers (pp. 28–30).—A brief account is given of experiments reported in more detail in a previous publication of the station (E. S. R., 8, p. 517).

Feeding experiments with sheep (pp. 30–38).—In 1895–'96 a test of 96 days' duration was made with 220 lambs, divided into lots of about 35 each, to compare barley, corn, wheat, beets, and a mixture of barley and corn. All the grains were fed ground. Few details of the experiment are recorded and only the results for barley are reported.

Results of sheep-feeding experiments, 1895–'96.

	Food consumed.					Gain in weight per head.
	Hay.	Barley.	Corn.	Wheat.	Beets.	
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Lot 1	300	86				27
Lot 2	294		86			28
Lot 3	321				375	22
Lot 4	227			77	218	26
Lot 5	181	32	56			26
Lot 6	191	32	56			26

Wheat and common barley have given practically the same results, as have also common barley and corn, there being a slight difference in favor of the corn. Barley and corn fed separately gave somewhat better results than when fed together.

During the winter of 1896–'97 a test, covering 179 days, was made with 440 lambs divided into 10 practically equal lots. All the lots were fed alfalfa hay, and one lot also received silage. The grains used were common barley, bald barley, and corn, fed ground and unground. The test was divided into 4 periods, of 47, 92, 21, and 20 days, respectively. During the first period lots 1 to 4 were given hay only, and lots 5 to 10 received a small amount of grain in addition to hay. In the second period all the lots were fed grain in amounts not exceeding a pound. In the third period all the lots except 2, 9, and 10 were given $1\frac{1}{4}$ lbs. of grain per day, the lots enumerated consuming somewhat smaller amounts. During the fourth period all the lots were fed whole corn. The results are briefly summarized in the following table:

Results of sheep-feeding experiments, 1896–'97.

	Food consumed.			Gain in live weight.
	Hay.	Grain.	Silage.	
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Lot 1 (ground corn)	16, 969	4, 690		38
Lot 2 (ground bald barley)	18, 183	4, 279		33
Lot 3 (whole bald barley)	17, 996	4, 618		38
Lot 4 (ground corn and barley)	17, 442	4, 618		37
Lot 5 (silage and ground corn)	8, 946	3, 181	19, 926	40
Lot 6 (whole corn)	14, 570	5, 220		44
Lot 7 (ground corn)	15, 216	5, 176		42
Lot 8 (whole common barley)	16, 856	5, 173		40
Lot 9 (ground common barley)	15, 637	5, 047		38
Lot 10 (ground bald barley)	13, 958	4, 767		38

Feeding grain from the start produced better and cheaper gains than feeding hay for 6 weeks before grain was fed. Better and cheaper gains were made on whole grain than on ground grain. Corn, ground or unground, gave better returns than common barley. When fed in moderate amounts, slightly better gains were made on bald barley than on corn. Corn and bald barley mixed did not yield better returns than corn alone.

Feeding separator milk to calves, C. F. CURTISS (*Iowa Sta. Bul. 35, pp. 759–768, figs. 6*).—In continuation of work previously reported (E. S. R., 4, p. 739; 6, p. 453), a test lasting 74 days was made with 3 lots of 4 calves each to study the comparative value of linseed meal, oatmeal, corn meal, and flaxseed, and corn meal fed with separator skim milk. Each lot received about 3,760 lbs. of separator skim milk and 1,480 lbs. of hay. In addition, lot 1 was fed 429 lbs. of linseed meal; lot 2, 605 lbs. of oatmeal; lot 3, 59 lbs. of flaxseed and 538 lbs. of corn meal; and lot 4, 601 lbs. of corn meal. The lots were kept in well-ventilated sheds with yards connecting. Salt and water were always accessible. The foods consumed, gains made, and cost per pound of gain are shown in the following table:

Summary of results of calf feeding.

	Nutritive ratio of ration.	Total gain.	Average daily gain per head.	Dry matter eaten per pound of gain.	Cost of feed per pound of gain.
		Pounds.	*Pounds.*	*Pounds.*	*Cents.*
Lot 1 (linseed meal)	1:3	483	1.63	4.13	2.5
Lot 2 (oatmeal)	1:4.1	498	1.68	4.31	2.2
Lot 3 (flaxseed and corn meal)	1:4.8	489	1.65	4.32	2.3
Lot 4 (corn meal)	1:4.9	509	1.72	4.16	2.0

The results obtained are compared with those of the previous tests.

"In each of the 3 experiments conducted by this station linseed meal has given lower and more expensive gains, and has been in every way less satisfactory than either oatmeal, or corn meal and flaxseed. . . . The results indicate that pure corn meal is superior to pure linseed meal for feeding to calves in combination with skim milk. . . .

"While the results of these experiments are contrary to prevailing opinion concerning the relative value of these feeds, it is not unnatural or in any way unreasonable that the carbonaceous grains should be more suitable for feeding with skim milk than a highly nitrogenous product like linseed meal."

Steer feeding experiments, VI, C. C. GEORGESON, F. C. BURTIS, and D. H. OTIS (*Kansas Sta. Bul. 67, pp. 55–73*).—The comparative value of corn and red and white Kafir corn was tested with 15 steers divided into 3 lots of 5 each. The steers were three-year-old grade Herefords or grade Shorthorns. All were dehorned, 5 of them a short time before the test began. From the time of their arrival at the station (about the first of October) until about the middle of the month the steers were pastured on a good meadow pasture, but were given no grain. From this time on until the beginning of the test proper they were fed a mixture of equal parts of corn and red and white Kafir corn finely ground in increasing quantities until 16 lbs. per head daily was fed. During the latter part of the preliminary period the steers were kept in a yard to accustom them to the experimental conditions of the test proper.

The experiment proper began November 3 and closed April 27. Lot 1 was fed corn meal, lot 2 red Kafir corn meal, and lot 3 white Kafir corn meal. In every case 16 lbs. of grain was fed per head daily, since it was found that a larger amount than this was not eaten up clean. Each lot was fed 100 lbs. of well-cured Kafir corn fodder, the uneaten residue being weighed back in every case. A little corn fodder and, near the close of the experiment, a little alfalfa hay were also fed. The financial statement is based on corn meal and Kafir corn meal at 30 cts., corn stover and Kafir corn stover at 12½ cts., and alfalfa at 20 cts. per 100 lbs. The steers were purchased for $3.52 and sold for $4.50 per hundred. The details of the experiment are reported in full. The average results were as follows:

Results of feeding steers.

	Average weight at beginning.	Average daily gain in weight.	Grain eaten per pound of gain.	Coarse fodder eaten per pound of gain.	Cost per pound of gain.	Profit per head.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Cents.*	
Lot 1 (corn meal)	1,036	1.86	9.97	5.69	3.73	$9.52
Lot 2 (red Kafir corn meal)	1,021	1.71	10.86	6.88	4.15	8.99
Lot 3 (white Kafir corn meal)	1,025	1.78	10.41	6.92	4.01	8.40

Practically the same gains were made by the 3 lots.

In order to determine the percentage undigested of the 3 grains the authors collected the manure from each lot for 33 days at the beginning of the experiment. Each day the manure was washed with water and constantly agitated. "This caused the manure particles to rise to the top and float away with the water, while the undigested meal settled to the bottom. Only an insignificant portion of the finest of the meal could be lost by this treatment." The amount of grain undigested is shown in the following table:

Digestibility of grain fed to steers.

	Grain eaten.	Weight (dry) of grain washed from manure.	Grain undigested.
	Pounds.	*Pounds.*	*Per cent.*
Lot 1 (corn meal)	2,982	162.77	5.46
Lot 2 (red Kafir corn meal)	3,008	340.36	11.27
Lot 3 (white Kafir corn meal)	3,008	425.09	14.13

The corn meal was better digested than either the red or white Kafir corn meal. The authors remark that, although the grains were all ground in the same mill, the corn was more finely ground than the Kafir corn.

Pigs following the steers.—To study the comparative value of the droppings from the different lots, 7 pigs followed each lot of steers from December 15 until the close of the test. The amount of grain fed to the pigs in addition is recorded. They were fed the same grains as the steers which they followed. At the beginning the average weight of the pigs following the different lots was 166, 168, and 169 lbs., respectively. On the basis of the undigested grain as determined above the food consumed, the gains made, and the food consumed per pound of gain were as follows:

Results of experiment with pigs following steers.

	Grain eaten.	Feed available in manure.	Gain in weight.	Food consumed per pound of gain.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Lot 1 (corn meal)	2,520	705	635	5.07
Lot 2 (red Kafir corn)	2,520	1,475	698	5.72
Lot 3 (white Kafir corn)	2,480	1,842	725	5.96

It is evident from the table that, though the pigs were fed practically the same amounts of grain, the gains made vary with the amounts found in the manure. In the authors' opinion the experiment proves that pigs can utilize Kafir corn feed in the manure and bring out the value in pork in about the same ratio of values that exists between corn and Kafir corn.

The pigs were not all sold, but from available data it was calculated that there would have been a profit of $7.10 for lot 1, $10.12 for lot 2, and $11.21 for lot 3. Records were kept of the mean daily temperature of the yards throughout the whole experiment.

Feeding lambs, C. F. CURTISS and J. W. WILSON (*Iowa Sta. Bul. 35, pp. 717–749, figs. 18*).—In continuation of work previously reported (E. S. R., 9, p. 84) the authors made a feeding experiment with 81 wether lambs of the following breeds: Southdown, Shropshire, Oxford, Suffolk, Lincoln, Leicester, Cotswold, Dorset, and Merino, and 10 Shropshire ewe lambs.

The lambs were divided into 7 lots of 9 each, 1 lot of 10, and 1 lot of 8. Most of the lambs were purchased in Canada and arrived at the station during July and August. They were dipped soon after their arrival and put on a timothy and blue grass pasture, and given a light ration of oats and bran in addition. The lambs were given worm powders, which were found to be more of a preventive than a remedy. The general conditions were the same as in the previous experiment. The experiment proper, which was preceded by a preliminary period of 15 days, began December 16 and continued 106 days, the conditions being the same throughout the whole time.

The lambs were fed all they would eat of a mixed grain ration with roots and hay. During the early part of the test a little green clover was fed. For the first 15 days the grain ration consisted of bran, oats, and corn, 1:2:2. For the next 35 days the following mixture was fed: Linseed meal, bran, oats, and corn, 1:2:8:8. During the remainder of the test the linseed meal was increased two-fifths. At the beginning of the test the lambs ate 1 to 1½ lbs. of grain daily and at the close from 1½ to 2¼ lbs.

The financial statement is based on bran and oats at 35 cts., shelled corn and hay at 20 cts., linseed meal at 90 cts., roots at 5 cts., and cabbage at 10 cts. per 100 lbs.

The details of the experiment are given in tabular form. The results are summarized in the following table:

Results of feeding different breeds of lambs.

	Food consumed.						Average daily gain per head.	Dry matter eaten per pound of gain.	Cost of food per pound of gain.
	Corn and oats.	Bran.	Linseed meal.	Hay.[1]	Roots.	Cabbage.			
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lb.*	*Lbs.*	*Cents.*
Lot 1 (Southdown)	1,653.1	203.6	127.4	2,089.0	305.5	1,115.5	0.35	9.89	3.12
Lot 2 (Shropshire)	1,588.2	195.6	112.6	2,188.5	354.0	1,124.2	.36	10.26	3.21
Lot 3 (Oxford)	1,714.4	213.5	121.5	2,567.4	363.5	1,142.0	.40	10.31	3.22
Lot 4 (Suffolk)	1,698.8	209.8	119.8	2,542.5	415.4	1,045.8	.40	10.36	3.44
Lot 5 (Lincoln)	1,752.2	216.1	124.5	2,529.1	259.0	1,239.0	.46	9.11	2.86
Lot 6 (Leicester)	1,715.4	211.8	121.7	2,554.5	335.2	1,236.2	.44	9.34	2.93
Lot 7 (Cotswold)	1,759.6	217.0	119.5	2,620.8	361.4	1,237.6	.50	8.48	2.65
Lot 8 (Dorset)	1,760.6	211.1	101.7	2,704.5	351.5	1,092.5	.43	9.89	3.04
Lot 9 (Merino)	1,377.6	141.3	104.3	2,155.4	308.5	940.7	.37	10.29	2.91
Total all breeds	15,021.1	1,819.8	1,053.1	21,516.8	2,895.4	10,173.5	.412	9.67	3.04
Total, first 7 breeds	11,882.9	1,467.4	847.0	16,881.8	2,314.4	8,140.3	.415	9.58	3.04
Lot 10 (Shropshire ewes)	1,415.0	176.5	99.7	2,135.0	335.5	1,099.5	.31	10.30	3.18

[1] Including a little green clover.

The ewe lambs were light eaters and made comparatively small gains, but the cost of production was about the same as the average of the wethers.

"The marked increase in the cost of feed per pound of gain during the experiment was apparently due to the fact that the ewe lambs took on fat rapidly and were more nearly finished during the latter part of the period than the other lots. This distinction between the sexes has been observed in all of the experiments made at this station, including both cattle and sheep. On the market the ewes sold 5 cts. higher than the wethers of the same breed, and in the slaughter test they dressed 1.67 per cent more net carcass. On the block they showed slightly more fat, but their fine bone and plump, neat carcasses made them attractive and profitable. The price put on them by the buyers clearly indicates that there is no discrimination against ewe lambs, as there formerly was against the heifer. It should be mentioned incidentally, however, that after the ewes are a year old they are not as desirable as wethers, owing to the fact that the joints do not break as readily. Free clean breaking of the front pastern is the test applied by meat dealers to distinguish between a lamb and a sheep. One that breaks is a lamb; one that does not is a sheep, regardless of actual age."

As regards gains made the relative rank of the breeds was the same in this as in the preceding experiment.

"The Cotswolds again lead, with the Lincolns and Leicesters closely following. The general average for the Southdowns and Shropshires is the same, and their rank is next to the long-wooled breeds for economy of production, and in this they are followed closely by the Dorsets, and they in turn by the Oxfords and Suffolks. . . . The whole number of lambs, 109 in the first experiment and 91 in the second, not including the ewes, made a total gain of 8,246 lbs. from 69,134 lbs. (dry matter) of feed—a rate of 1 lb. of gain for 8.38 lbs. of dry matter in the feed consumed, and an average of 0.448 lb. per head daily for the entire lot. The total gain of 8,246 lbs. was made at a cost of $245.69 for feed consumed, or an average cost of 2.97 cts. per pound for the mutton produced in both experiments. This calculation makes no allowance for the value of the fleece, except as it entered into the gain, nor does it take into account the value of the manure or expense of labor in feeding."

At the close of the test the wethers were sold in Chicago for from $5 to $5.75 per hundred, and the ewes for $5.65. The dressed weight of the wethers was 49.27 to 55.26 per cent of the live weight, and the dressed weight of the ewes 54.55 per cent. A detailed record is given in tabular form of the slaughter test, which shows the net weight of the several parts of the carcass and of the internal organs and their percentage of the whole. The carcasses were cut up and the meats judged by an expert. In his opinion the Southdowns and the Shropshire ewes ranked highest in the value of the mutton; the Oxfords, Lincolns, and Leicesters next, and the Suffolks, Dorsets, and Merinos lowest.

The sheep were not shorn as in the former experiment. The value of the fleece was calculated from the combined weight of pelts and wool.

Feeding range lambs, C. F. CURTISS and J. W. WILSON (*Iowa Sta. Bul. 35, pp. 750–758, figs. 4*).—A test was made with 252 range lambs to study the possibilities of profitable feeding under local conditions. The lambs were divided into 4 lots of 63 each, and consisted of the following breeds: Lot 1, Merinos (shorn); lot 2, Cross Wools; lot 3, Down Coarse, and lot 4, Merinos (unshorn). The lambs were purchased November 3. The feeding experiment began December 1 and lasted 110 days. Until the beginning of the feeding trial the lambs were pastured on blue grass and given a light ration of bran and oats morning and evening. They also had access to hay during the night. During the experiment proper they were fed a ration consisting of oats, corn, linseed meal, and bran, with mangel-wurzels and hay in addition. At the beginning of the test the lambs ate less than $\frac{1}{4}$ lb. of the mixed grain per day, at the end of the first month only $\frac{1}{3}$ lb., while the hay consumed per day was at first as high as $3\frac{1}{2}$ lbs. per head. The amount of hay consumed gradually decreased to about 2 lbs. at the end of the test and the amount of grain increased.

The financial statement is based on the following prices per 100 lbs.: Bran and oats, 35 cts.; hay and shelled corn, 20 cts.; linseed meal, 90 cts., and roots, 5 cts.

The foods consumed and the gains made by the different lots are given in full. The average weights of the lambs in the different lots at the beginning were as follows: Lot 1, 46.9 lbs.; lot 2, 52.8 lbs.; lot 3, 53.8 lbs., and lot 4, 53 lbs. The average gains made were 29.2 lbs., 28.3 lbs., 28.9 lbs., and 27.6 lbs., respectively.

"It will be observed that while these lambs have not made as large gains as the pure breds and have required more feed (dry matter) for a pound of gain, they have nevertheless produced very creditable gains at unusually low cost for feed consumed. The greater amount of feed and lower cost for a pound of gain by these lambs, in comparison with the pure breds, seems like an inconsistent result. This apparent inconsistency, however, is doubtless due to the variation in the rations consumed.

"The pure-bred lambs ate relatively much less hay and correspondingly more grain, consequently the results with respect to economy of production between the pure bred and the range lambs are not directly comparable. The hay fed to the range lambs was alfalfa a part of the time, and clover and timothy of good quality the remainder. On account of their taking readily to a liberal allowance of hay and eating sparingly of grain, a ration of this kind seemed best suited to these lambs, while the pure breds were capable of utilizing a heavier grain ration with correspondingly less hay. Both lots of lambs had all the grain they would eat during the last sixty days."

The lambs were sold in Chicago at from $4.70 to $5.25 per hundred. The percentage of dressed weight of the several lots was as follows: Lot 1, 55.9; lot 2, 53.5; and lots 3 and 4, 52.8. The net profit per head for the 4 lots was 42 cts., 75 cts., 87 cts., and 70 cts., respectively.

"While these lambs are not of the class that farmers could afford to raise on high-priced lands, they can, nevertheless, be fed at a good profit under conditions similar to those reported in this bulletin."

Is skim milk or buttermilk best for pigs? F. E. EMERY (*North Carolina Sta. Bul. 143, pp. 170–175*).—A test of the comparative value of skim milk and buttermilk was made with 12 pigs divided into 4 lots of 3 each. Lots 1 and 2 were fed sweet skim milk and middlings, lot 2 receiving 25 per cent more milk than lot 1. Lots 3 and 4 were fed buttermilk and middlings, lot 4 receiving 25 per cent more buttermilk than lot 3. The pigs had access during the test to a mixture consisting of hard-wood ashes, salt, copperas, black antimony, sulphur flowers, and charcoal. The pigs were farrowed early in September. The boars were castrated before weaning. After weaning, until the experiment proper began, the pigs were fed a mixture of wheat middlings, corn, bran, and linseed meal. The experiment proper began December 26 and lasted until March 30. The food consumed and gains made are recorded. During the whole test the pigs in lots 1, 2, and 3 gained from 17 to 19 oz. per day, and the pigs in lot 4 made an average gain of about 14.5 oz. per day. Reckoning the middlings at 85 cts. per 100 lbs. and the pigs at 4 cts. per pound live weight or 5 cts. per pound dressed weight (it being assumed that the dressed weight was 80 per cent of the live weight), the value of 100 lbs. of skim milk and buttermilk was calculated. The results of the experiment are shown in the following table:

Results of feeding pigs.

	Food consumed per pound of gain.			Value of milk per 100 pounds.
	Wheat middlings.	Skim milk.	Butter-milk.	
	Pounds.	*Pounds.*	*Pounds.*	*Cents.*
Lot 1	3.43	5.12	....	20.80
Lot 2	3.26	6.12	....	20.80
Lot 3	3.51	....	5.10	19.78
Lot 4	2.78	....	5.72	28.62

The pigs were slaughtered at the close of the experiment or shortly after. Br ef statements are made concerning the slaughter test.

Report of the poultry division, C. O. FLAGG (*Rhode Island Sta. Rpt. 1896, pp. 354–362*).—Analyses (food constituents and mineral matter) are reported of a number of poultry foods as follows:

Composition of poultry foods.

	Food constituents.						Mineral matter.				
	Water.	Protein.	Fat.	Nitrogen-free extract.	Fiber.	Ash.	Calcium oxid.	Magnesium oxid.	Potassium oxid.	Phosphoric acid.	Insoluble matter.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Common navy bread	9.17	16.38	1.34	70.64	1.06	1.41	0.12	0.17	0.25	0.63	0.02
Austin's dry bread	10.33	16.88	4.33	63.12	1.02	4.32	.53	.14	.35	.98	.03
Brooklyn azotine	10.58	58.00	11.13	5.22	.00	15.07	4.25	.16	.72	4.02	.67
Boiled blood and bone	7.35	29.31	2.07	8.37	.00	52.90	26.84	.69	.38	21.81	.84
Bowker's animal meal	5.03	33.94	19.50	8.14	.00	33.39	16.20	.31	.33	13.38	.76
Smith's beef scraps	7.03	36.69	15.43	22.62	.00	18.23	6.36	.25	.78	4.94	1.41
Avery's beef scraps	6.89	55.31	24.50	1.58	.00	11.72	3.87	.18	.79	4.96	.33
Darling's ground scraps	8.72	52.13	13.83	3.62	.00	21.70	8.18	.27	.67	6.88	2.13
Germ feed	9.45	45.69	2.00	3.65	.00	39.21	19.14	.46	.38	15.30	.36

In continuation of previous work (E. S. R., 8, p. 622) experiments were made in cross breeding geese, which are briefly reported. A number of the geese raised were fattened and sold and others were exhibited. The first geese were sold when 97 days old; the best were the result of crossing an Embden gander with African geese; their average live weight was 15 lbs. $3\frac{4}{9}$ oz., and the average dressed weight 13 lbs. $7\frac{5}{9}$ oz. The Embden-Toulouse cross also developed large geese, but they did not grow as rapidly as the Embden-African.

"It appears to be desirable to use a white bird for one parent in making a cross, in order, so far as possible, to grow white, pied, or light-colored birds for market, because they pick much easier, usually have a whiter flesh, and are handsomer in appearance. These are important points, and affect the price when the bird comes on the market. Entirely dark birds, as Africans, Toulouse, or Brown Chinas, have black pinfeathers, which make them hard to pick when dressed as green geese. If they are not thoroughly taken out they show on the dressed bird very distinctly, and injure the appearance, while white pinfeathers are much less objectionable. The color of the flesh, aside from the effect of the black or white pinfeathers is, as a rule, in favor of the white or light-colored bird. Toulouse, Brown China, and African geese, unless very fat, are generally of a darker appearance when dressed than Embdens or White Chinas."

The importance of an abundant supply of pasturage for geese is insisted upon and the need of supplementing any lack in this direction by suitable soiling crops. Grass seems to be preferred by geese to all other green crops. When pastured on oats and peas the oats were always eaten before the peas. Cabbage, turnips, and sweet corn are regarded as excellent soiling crops. Sweet corn sufficiently advanced to be in the roasting-ear stage will be almost or quite devoured when fed at night. Sorghum and dwarf Essex rape were found to be very satisfactory green crops.

Blood-molasses feed for horses, E. J. HANSEN (*Ugeskr. Landm., 43 (1897), No. 50, pp. 672–674*).—The process of manufacturing the molasses feed is explained in detail. The feed is a mixture of 250 parts of blood, 200 parts beet molasses, 200 parts Scotch oat bran, and 100 parts "starch-free maize meal." Analysis shows its composition to be as follows: Water 10.10, protein 19.63 (albuminoids 16.48), ether extracts 2.00, crude fiber 6.32, nitrogen-free extract 55.11, and ash 6.84 per cent. The feed was relished by horses. A blood molasses feed for cattle and one for swine are also manufactured.—F. W. WOLL.

Composition of hay from mountain pastures, F. H. WERENSKIOLD (*Tidsskr. Norske Landbr., 4 (1897), pp. 427–430*).—Six analyses of hay from Norwegian mountain pastures (*säterhö*) are given, and the results discussed and compared with earlier analyses of similar hay and of meadow hay. Of the total protein 61.5 per cent was found to be digestible by the Stutzer-Kühn method. The analyses indicate that the hay from the mountain pastures possesses a higher nutritive value than the cultivated grasses, and perhaps as high value as the cultivated legumes. Their crude fiber content, in connection with the relatively high percentage of moisture which they contain, makes the grasses tender and soft when cured. Such hay may be more palatable to cattle than the rather stiff hay from the common cultivated fodder plants.—F. W. WOLL.

What the Mexicans eat (*Dietet. and Hyg. Gaz., 14 (1898), No. 3, pp. 144–146*).—An abstract of a paper by F. Semeleder read before the section of physiology and dietetics of the American Medical Association at its last meeting. A number of typical foods and food products are enumerated and some are described.

Boarding houses and clubs for working women, MARY S. FERGUSSON (*U. S. Dept. Labor Bul. 15, pp. 141–196*).—A number of boarding houses and clubs conducted under the auspices of charitable or other organizations are described and discussed. Statistics which include cost of food are given of 90 institutions.

The composition of different kinds of flour used in Italy, G. FABRIS and O. SEVERINI (*Ann. Gabelle. Roma, 3, p. 27; abs. in Bul. Soc. Chim. Paris, 20 (1898), No. 2, pp. 109, 110*).—A large number of Italian flours were examined. A classification is given based on the ash content. Thus, first-class flour shows an ash content of about 0.6 per cent, medium 0.6 to 1 per cent, and ordinary above 1 per cent.

Flour in China and Japan (*U. S. Consular Rpts., 1897, Dec., pp. 519–528*).—Statistics as to the amount of flour used in cities in China and Japan and its source. The bread and similar products made from flour in a number of cases are described.

Adulteration of wheat flour, A. J. WEDDERBURN (*U. S. House of Rep., 55. Congress, 2. Session, Doc. 309, pp. 42*).—The author, under the direction of the Division of Chemistry of this Department, has gathered from a number of manufacturers and millers information concerning adulteration of flour.

The use of horse flesh as food (*Rev. Sci., 4. ser., 8 (1897), No. 24, p. 762*).—The use of horse flesh in different countries is briefly discussed, and its composition compared with that of beef, mutton, and pork.

Consumption of food products in the United Kingdom (*Jour. Bd. Agr.* [*London*], *4, No. 12, pp. 293–300*).—The article gives statistical information of the kind and amount of food consumed.

Mushrooms—their economic and pathological relations (*Dietet. and Hyg. Gaz., 14* (*1898*), *No. 3, pp. 147–149*).—A general article quoted from an address by H. G. Piffard.

Prickly pear (*Agr. Gaz. New South Wales, 9* (*1898*), *No. 1, pp. 38–40*).—This article, quoted from a paper by P. Gennadius, describes the culture of the prickly pear, the different varieties, and the use of the fruit as food and the plant and fruit as a feeding stuff.

Ensilage up to date, J. L. Thompson (*Agr. Gaz. New South Wales, 9* (*1898*), *No. 1, pp. 68–106, figs. 8*).—Opinions of many writers and reports of experiments with silage are quoted, and directions given for making and filling silos, silage stacks, etc.

The utilization of beet leaves, J. P. Wagner (*Jour. Agr. Prat., 2* (*1897*), *No. 38, pp. 448–450*).—The value of beet fodder and silage is discussed.

Soy beans as food and fodder, S. H. Angell (*U. S. Consular Rpts., 1897, Dec., pp. 551, 552*).—A translation of a general article by H. Furtune.

Composition of the straw of oats, wheat, and rye, Balland (*Compt. Rend. Acad. Sci. Paris, 125* (*1897*), *No. 25, pp. 1120–1122*).

Analyses of potatoes, B. H. Hite (*West Virginia Sta. Rpt. 1896, pp. 50-57*).—Determinations of specific gravity, total solids, water, starch, protein, fiber, fat, other carbohydrates, and ash soluble and insoluble in water in over 200 samples of potatoes are reported, and the methods of analysis used are described. No average or summary is given.

Studies of Norwegian potatoes, with special reference to starch content, J. Sebelien (*Tidsskr. Norske Landbr., 4* (*1897*), *Nos. 5, pp. 209–225; 6, pp. 259–278*).

Feeding sprouted grains, O. Kellner (*Sach's Landw. Ztschr., 45* (*1897*), *No. 13, p. 58*).—The inferior value of sprouted grain on the basis of composition is pointed out.

The digestibility of dried maize used for brewing (*Deut. Landw. Presse, 24* (*1897*), *No. 76, p. 699*).—Quoted from an article by B. Schulze in Jahresber. Agr. Chem. Vers. Stat. Breslau, 1896.

Skim-milk bread and its assimilation by man, H. Repsteiner and W. Spirig (*Korbl. Schweiz. Aerzte, 25, pp. 705–710; noted in Jahresber. Thier. Chem., 25* (*1895*), *p. 451*).—Experiments were made which, in the authors' opinion, showed that bread made with skim milk was extremely well assimilated. They recommend the use of skim milk (and buttermilk) in bread making.

Preservation of eggs, J. H. Thieriot (*U. S. Consular Rpts., 1897, Dec., pp. 563, 564*).—A report is given of tests in Germany of 20 methods of preserving eggs. The most satisfactory methods were varnishing the eggs with vaseline and preserving them in limewater or a solution of water glass. The latter was preferable since varnishing the eggs with vaseline takes considerable time and treating them with limewater is likely to give the eggs a disagreeable odor and taste. "There is, however, one drawback with eggs preserved in a solution of water glass, viz, that the shell easily bursts in boiling water. This may be avoided by cautiously piercing the shell with a strong needle."

Peat dust for preserving eggs (*Landw. Centbl. Posen, 25* (*1897*), *No. 34, p. 209*).—A note on the successful preservation of eggs by burying them in peat dust.

Food preservatives and butter increasers, G. W. Cavanaugh (*New York Cornell Sta. Rpt. 1896, pp. 459–464*).—A reprint of Bulletin 118 of the station (E. S. R., 8, p. 421).

On preservative salts, E. Hotter (*Ztschr. Nahr. Untersuch. u. Hyg., 11* (*1897*), *No. 20, pp. 334, 335*).—A discussion of the subject with analysis of a preservative salt.

Supplemental report of the dairy and food commissioner, L. Wells (*Pennsylvania Dept. Agr. Rpt. 1896, p. 466*).—Examinations of a number of samples of vinegar, baking powder, and miscellaneous foods and condiments are reported, and a court decision in favor of the pure-food law of the State is cited.

Cider vinegars of Pennsylvania, W. FREAR (*Pennsylvania Dept. Agr. Bul. 22, pp. 27*).—Vinegar and vinegar making is discussed and a number of analyses of vinegar from different localities in Pennsylvania are reported. Directions for testing vinegar and a test for acidity suited to the needs of farmers are given.

Cider vinegars of Pennsylvania, W. FREAR (*Pennsylvania Dept. Agr. Rpt. 1896, pp. 493–513*).—This is a reprint of Bulletin 22 of the Pennsylvania Department of Agriculture (see above).

Fruit vinegar, J. JETTMAR (*Ztschr. Nahr. Untersuch. u. Hyg., 11 (1897), No. 21, pp. 345, 346*).—A discussion of fruit vinegars, with report of analyses of 2 samples.

The value of meat extract as a condiment, C. VOIT (*München. Med. Wchnschr., 1897, No. 9; abs. in Hyg. Rundschau, 7 (1897), No. 24, p. 1263*).

The examination of American lard, H. SCHLEGEL (*Forsch. Ber. Lebensmtl., 4 (1897), No. 12, pp. 350, 353*).

On the establishment of compulsory examination of meat in the States of the North German Federation, R. OSTERTAG (*Ztschr. Fleisch u. Milchhyg., 8, No. 2, pp. 21–27*).

Book of foods and condiments (*Lebensmittelbuch. Bern: F. Semminger, 1897, pp. VII, 152; abs. in Ztschr. Nahr. Untersuch. u. Hyg., 11 (1897), No. 24, p. 424*).—A compilation by the *Verein schweizerischer analytischer Chemiker*, describing the more important foods, condiments, etc., and their adulteration, with simple methods of examination.

What influence does consuming a day's ration in several portions exert upon the cleavage of protein? O. KRUMMACHER (*Ztschr. Biol., 35 (1897), No. 4, pp. 481–505, dgms. 2*).—The author made a number of experiments with a dog. In some cases the day's ration was consumed in one portion and in others in five portions. The food, urine, and feces were analyzed. It was found that more nitrogen was excreted when the food was consumed in one portion than otherwise. The experiments are discussed at length and the results of other investigators quoted in detail.

Investigations with man and animals on the behavior and excretion of ammonia and ammonium salts, T. RUMPF and G. KLEINE (*Ztschr. Biol., 34 (1897), pp. 65–124*).

On the mineral constituents of the feces of very young infants when fed mother's milk and cow's milk, M. BLAUBERG (*Arch. Hyg., 31 (1897), No. 2, pp. 115–141*).

Some recent observations on the influence of the thyroid gland on metabolism, Y. HENDERSON (*Science, n. ser., 6 (1897), No. 156, pp. 948–950*).—The work of several investigators is quoted in considerable detail.

On the analysis of gastric juice, L. CORDIER (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 4, pp. 353–356*).

Hygienic studies of copper, VI. The effect of copper on man, K. B. LEHMANN (*Arch. Hyg., 31 (1898), No. 3, pp. 279–309*).—Large doses of copper salt (about 30 gm.) prove fatal or cause serious illness. No case is recorded in which doses of 4 to 8 gm. have proved fatal, 1 to 2 gm. cause sickness (vomiting or diarrhea), 0.5 gm. seldom causes even vomiting. Continued small doses show no cumulative effects. A number of experiments are reported.

Papain-proteolysis, with some observations on the physiological action of the products formed, R. H. CHITTENDEN, L. B. MENDEL, and H. E. MCDERMOTT (*Amer. Jour. Physiol., 1 (1898), No. 2, pp. 256–276*).—A number of experiments are reported.

Text-book of somatology and hygiene for use in training schools for teachers. T. F. HANANSEK (*Lehrbuch der Somatologie und Hygiene für Lehrer und Lehrerinen Bildungsanstalten. Vienna, Prague, and Leipsic: F. Tempsky, 1897, pp. VI, 158, pls. 7, figs. 104; abs. in Ztschr. Nahr. Untersuch. u. Hyg., 11 (1897), No. 24, p. 424*).—Contains chapters on somatology, general hygiene, and school hygiene. The most important foods and food stuffs are treated of.

Stock-feeding suggestions, J. M. BARTLETT (*Maine Sta. Bul. 39, pp. 8*).—General remarks on feeding, with tables showing digestible nutrients in various feeding stuffs, and rations for milch cows, work cattle, growing cattle, and horses.

The beef steer (*Kansas State Bd. Agr. Quart. Rpt. 1897, Dec. 31, pp. 282, figs. 37*).—This contains articles on beef production in Kansas and elsewhere and crop and live stock statistics for the State.

Shorthorns in France and England, DE CLERCQ (*Jour. Agr. Prat., 2 (1897), No. 34, pp. 301–306*).

On heredity in stock raising, with special reference to transmitted qualities, H. SAVELA (*Biet, 18 (1897), pp. 291–301*).

The development of the Jutland breed of cattle during the past 25 years (*Landmansblade, 30 (1897), Nos. 35, pp. 473–477; 36, pp. 488–491*).

The importance of horse raising for the farmer and the army, C. F. MICHELET (*Tidsskr. Norske Landbr., 4 (1897), No. 6, pp. 241–259*).

The old Nordland horse, L. P. NILSSEN (*Tidsskr. Norske Landbr., 4 (1897), No. 7, pp. 359–361, ill.*).

Size and weight of horses, F. A. ZÜRN (*Fuhling's Landw. Ztg., 47 (1898), No. 1, pp. 13–21*).—A general discussion of the subject.

Fowls for profit, J. J. MCCUE (*Agr. Gaz. New South Wales, 9 (1898), No. 1, pp. 56–59*).—A general article.

Oysters in Point Judith Pond, G. W. FIELD (*Rhode Island Sta. Rpt. 1896, pp. 172–186, pls. 5*).—A report is given of experiments on the possibility of profitably extending oyster growing in Point Judith Pond.

DAIRY FARMING—DAIRYING.

Eighth and ninth years' feeding experiments with milch cows, F. FRIIS (*Ber. K. Vet. Landbohöjskoler Lab. Landökon. Försog [Copenhagen], 1897, pp. 107*).—This is a continuation of the Danish cow feeding experiments made by the experiment station at Copenhagen (E. S. R., 4, p. 601; 6, pp. 588, 657; 8, p. 255). The report covers the experiments of 1895 and 1896, which were made on the same general plan as the earlier ones. The main results of the experiments of 1895, which were on the comparative value of mixed grain (barley and oats) and wheat for milk and butter production, were given in an earlier publication of the station and have already been abstracted (E. S. R., 8, p. 255).

The experiments of 1896 were conducted on 4 different estates with 152 cows in all, their purpose being to study the value of molasses feed as compared with mixed grain (barley and oats). The molasses feed was made up of one half beet molasses, three-eighths wheat bran, and one-eighth palm-nut meal. The cows on each estate were divided into 3 even lots of at least 10 head each. One of these lots (B) received the same feed throughout the experiment, viz, equal parts of mixed grain and molasses feed. The feed of the 2 other lots (A and C) was the same as that of lot B during the preliminary and the post-experimental periods, but during the experimental period proper lot A had mixed grain only and lot C molasses feed. The report gives detailed statements and tables as to the rations fed, live weights of animals, yield and composition of milk produced on each estate, and the composition of the various cattle foods used. The following summary includes the more important results:[1]

Molasses feed vs. mixed grain for cows.

	Yield of milk.			Fat content of milk.			Live weight of cows.		
	Lot A (mixed grain).	Lot B (grain and molasses feed).	Lot C (molasses feed).	Lot A (mixed grain).	Lot B (grain and molasses feed).	Lot C (molasses feed).	Lot A (mixed grain).	Lot B (grain and molasses feed).	Lot C (molasses feed).
	Lbs.	*Lbs.*	*Lbs.*	*Per ct.*	*Per ct.*	*Per ct.*	*Lbs.*	*Lbs.*	*Lbs.*
Preliminary period	27.3	27.4	27.4	3.25	3.23	3.26	969.0	958.0	963.0
Experimental period	23.7	23.7	23.4	3.16	3.12	3.15	970.7	959.5	965.0
Supplementary period	21.8	21.6	21.6	3.27	3.21	3.27	969.2	959.0	964.6

The results of the experiments indicate that molasses feed and mixed grain (barley and oats) possess the same feeding value, pound for pound, for milch cows when fed in similar food combinations as in these experiments, viz, with oil cakes, roots, hay, and straw. Even when 3.3 lbs. of molasses feed was fed with 55 lbs. of mangel-wurzels per day, no deleterious effect could be traced in the digestion of the cows.

Sugar-beet residue and molasses feed vs. mixed grain.—In a single experiment at the Ourupgaard estate during 1895–'96 with 28 cows divided into 2 even lots, 2 lbs. of mixed grain, 2 lbs. of molasses feed, and 20 lbs. of sugar-beet residue were fed to 1 lot, and 2 lbs. of molasses feed and 44 lbs. of beet residue were fed to the other lot. All the cows received oil cakes and hay in addition. Hence 24 lbs. of sugar beet residue was compared with 2 lbs. of mixed grain (barley, oats, with a little peas, grown together). The yield and composition of the milk produced and the weight of the cows indicated that the feeds mentioned were of about similar value, in the proportions fed.

The effect of food on quality of milk.—The general conclusion on this point to which these Danish cow-feeding experiments have led is given as follows: In the comparative feeding experiments with milch cows, now continued during 9 consecutive years, in which about 2,500 cows divided into 218 lots on 12 estates in different parts of our country have been included, it has constantly been found that the changes made in the system of feeding the different lots have been practically without effect upon the chemical composition of the milk. In these experiments, barley and oats have been fed against roots, oil cakes, wheat bran, wheat and molasses feed; mixed grain and oil cakes have been fed against roots, and grain and roots have been fed in addition to the regular rations given. It must be remembered, however, that the changes in the feed were never so great as to make the resulting rations abnormal (according to Danish feeding practice).—F. W. WOLL.

Comparative effect of some rations fed to milch cows, F. E. EMERY (*North Carolina Sta. Bul. 143, pp. 161–169*).—The results are

[1] The Danish pound = 1.1 lbs. avoirdupois.

given of trials with 4 cows in 4 periods of 2 weeks each. In these trials cotton-seed meal and hulls was fed against corn shucks and a mixed grain ration; and corn and soy bean silage with cotton-seed meal and bran was fed against 2 different grain rations containing sweet potatoes. The author makes the following deductions:

"(1) The ration of sweet potatoes, raw cotton seed, pulled [corn] fodder and cowpea meal gave better results for cow Dora McKee than did corn and soy-bean silage and cotton-seed meal, with wheat bran mixed in ratio of 1 to 2, by weight.

"(2) The corn and soy-bean silage, with cotton-seed meal and wheat bran, gave a better result with cow No. 5 than did sweet potatoes and corn shucks, with a mixture of cotton-seed meal, corn meal, and cowpea meal mixed in the proportions of 6, 2, and 1.

"(3) Cotton-seed hulls and meal for butter production leads corn shucks and wheat straw with corn meal, ground wheat, and cotton-seed meal mixed in proportions of 2, 3, and 5. The latter made the most milk, however. Cow No. 19 lost in the last period so much, the result was evened up and became indeterminate."

Summary of record of milk and butter production of station herd, 1895 and 1896, F. E. EMERY (*North Carolina Sta. Bul. 143, pp. 176–187*).—This is a record for 14 cows in 1895 and 16 cows in 1896, showing the yield and fat content of milk, calculated yield of butter, amount and cost of food consumed, net profit or loss, etc. In 1895 8 of the 13 cows for which financial data are given either gave no profit or were kept at a loss ranging from \$2.26 to \$13.53; and in 1896 8 of the 16 cows were kept at a loss ranging from 92 cents to \$15.86. The author explains that some of the cows "have not been culled out before the end of this year's record in order to give time, after the trouble from epizootic abortion was over, for cows to assume a normal flow of milk, thus avoiding hasty judgment and consequently erroneous work."

Milk: Its value as a food and studies which suggest a different method of sale, E. B. VOORHEES and C. B. LANE (*New Jersey Stas. Bul. 123, pp. 19*).—The value of milk as a nutritious food of moderate cost is pointed out, and the variations in the quality of milk owing to a variety of causes are discussed.

Observations are reported on the station herd of 28 cows, mostly of mixed breeding. The cows were fed so as to keep them up to their full capacity without attempting to force a large yield. Samples of the milk of each cow were tested weekly. The average monthly composition of the milk of the herd for 1 year and the variations in the composition of the milk of individual cows are given. These show that, while there were wide variations in the milk of individual cows, the range being from 2.6 to 8.3 per cent of fat in the month of December, the composition of the mixed milk of the herd was remarkably uniform, the monthly average ranging from 4 to 4.4 per cent during the year.

"In other words, it appears, from the study of this herd, which is fairly representative of good herds throughout the State, that, so far as uniformity in composition of the daily mixed milk is concerned, its sale on the fat basis would have been entirely practicable."

Observations were also made on the effect of the period of lactation and the character of the food. Although individual animals varied greatly, "in the first 5 months the decrease in total milk flow from month to month is proportionately greater than the decrease in the total fat, and hence the average percentage of fat in the milk gradually increases, so that in the fifth month it is 0.5 greater than the average percentage in the first month." For the remaining 3 months the decrease in milk yield and in total fat were relatively the same.

"The influence of the period of lactation upon the composition of milk, while varying with individual animals, is, therefore, for herds of reasonable size, practically limited to the first 5 months. Hence the main point to observe in attempts to secure uniformity in composition is to evenly distribute the fresh cows introduced into the herd throughout the different months of the year rather than to have them all introduced during any 1, 2, or 3 months."

The experiments on the effect of food included 4 lots of 2 cows each. The effect of substituting silage for dried corn fodder and of adding sugar beets and potatoes with a full ration, limited ration, and no grain was studied in periods of 5 or 12 days' duration.

"While the results of these experiments as a whole confirm the view now generally held by careful observers, viz, that the character and quantity of food influence the flow rather than the composition of milk, a temporary decrease in fat was noticed when animals were changed from a dry to a succulent ration and one much richer in digestible carbohydrates (sugar)."

In conclusion the author urges that milk should be sold on the basis of its fat content; "that is, from the food standpoint the retail price should vary with the variation in composition in order that the consumer may get what he pays for and the producer may be paid for what he delivers." The author believes that the results of his investigations show that this is entirely practicable as far as the dairyman is concerned, and is engaged in devising a system of inspection suited to this plan.

A flavor-producing micrococcus of butter, S. C. KEITH (*Tech. Quart., 10 (1897), pp. 247, 248, figs. 2; abst. in Jour. Roy. Micros. Soc.* [*London*], *1897, No. 5, p. 430*).—A micrococcus that produces a butter flavor and aroma when grown on milk or cream has been isolated by the author and designated as *Micrococcus butyri-aroma-faciens*. The micrococcus is characterized by usually occurring in pairs, by being nonmotile, measuring from 0.5 to 1μ in size, and by growing well at 37° and even at 20° C. It is aerobic and liquefies gelatin slowly. On agar its growth is white and abundant. Milk is not coagulated by it, but is given a slightly sour, pleasantly aromatic butter flavor. The reaction of the milk is acid.

Pasteurization of milk, C. E. MARSHALL (*Michigan Sta. Bul. 147, pp. 21–48, figs. 3*).—The object of this work was to study certain microorganisms found to be resistant to pasteurization. A new form of sterilizing apparatus is described, consisting of a tall can with a cover, stirring apparatus, and a faucet at the bottom for drawing off the milk. The can is placed in a jacket and surrounded by live steam.

In each of 26 experiments 2 bottles of the pasteurized milk and 2 bottles of the same milk unpasteurized were taken as samples, one set being tested for acidity and the resistant bacteria and the other set being kept until it spoiled. The data for these samples are given. From the pasteurized milk 39 varieties were isolated and studied. The characteristics of 19 varieties are given, since these are believed to be representative of the whole. The source of these resistant bacteria was studied by making numerous plate cultures of the dust in the air of the stable, the animal, etc. From these bouillon cultures were made of the different kinds of bacteria, and these cultures were pasteurized. Of those which resisted pasteurization 2 were from the dust of the stable, 2 from the dirt from the cow, 1 from the dairy, and 3 from the first part of the milking.

As to the effect of these resistant bacteria on the milk after pasteurization, it was found that some only curdled the milk, some peptonized the casein, some did both, while others produced no perceptible change in the milk.

A special experiment on the thermal death point of tubercle bacilli showed that heating the milk containing them at 68° C. for 20 minutes destroyed the bacilli, so that the milk had no injurious effect when inoculated into guinea pigs. A study of the thermal death points of the resistant bacteria showed that 17 of the 19 forms were not killed by a temperature of 80° C. for 20 minutes; 6 remained alive after heating the same time at 90° C., and 1 at 96° C., but all were killed by boiling 20 minutes. The effect of sudden cooling after pasteurization upon 6 of the resistant varieties was studied in a series of tests on bouillon cultures of these bacteria. In each case one culture was cooled suddenly to 8° C. and another allowed to cool gradually to the temperature of the room, the time required for development being noted in each case.

"In this work 10 cultures of the suddenly cooled exceeded the time of development of the noncooled; 12 cultures of the noncooled or cooled gradually exceeded the time of development of the cooled; 6 cultures of the suddenly cooled developed in the same time as the noncooled. Sudden cooling seems to have no effect on the time of development."

The restraining influence of keeping at a low temperature on development was shown in trials with the same 6 species. Six miscellaneous micro-organisms were treated in the same way but not subjected to pasteurization. Here it was noticed that the time of development was retarded several days by placing them in the refrigerator. The effect of continued heat in restraining development was illustrated in trials with the 6 same cultures. When the 6 cultures were pasteurized and then kept in a refrigerator very few of the germs developed in 45 days.

In conclusion, remarks are made on the value of pasteurization, especially in preventing contagious diseases and intestinal disorders of young children.

Quick and slow ripening of cream, G. L. McKay and G. H. Eckles (*Iowa Sta. Bul. 35, pp. 820–822*).—Nine trials were made, beginning the middle of May, in each of which 400 lbs. of cream were thoroughly mixed and then divided into two portions, one being cooled at once by the use of ice to about 55° F. and after 3 hours heated to 65° and ripened, and the other not cooled but ripened at a temperature of 70 to 75°. Both lots of cream were ripened to about the same degree of acidity. The butter was scored by a Chicago merchant. "The scores from the quick ripened averaged almost exactly the same as those from the slow ripened. What difference there was in scores followed the acidity and not the difference in the method of ripening." Several advantages of quick ripening are noted.

Butter colors, C. B. COCHRAN (*Pennsylvania Dept. Agr. Bul. 13, pp. 8*).—The nature and the toxic properties of 6 commercial butter colors were studied. The principal coloring matter of Hansen's Columbian, Wells, Richardson and Co.'s Improved, and Perry's Concentrated butter colors was found to be coal-tar products, and that of Hansen's Danish, Thatcher's Orange, and Annattoine was found to be annatto. The first 5 samples were solutions of the coloring matter in oil; the 6th was a finely divided powder. "No attempt was made to do more than find the principal coloring matter in each sample." The coal-tar colors found in the first 3 samples were found to be two in number—anilin yellow (amidoazobenzin) and butter yellow, closely resembling methyl orange.

Doses of 25 and 42 drops of Perry's Concentrated butter color were taken by persons without any ill effects. Doses of 2 gr. of anilin yellow and of methyl orange produced no unpleasant results. Both of the coloring matters were rapidly excreted in the urine. The physical and chemical tests of Wells, Richardson and Co.'s Improved, and Hansen's Columbian butter colors gave identical results. The physiological action of the two was very similar. Doses of 24 to 32 drops produced headache, loss of appetite, nausea, vomiting, and nervous depression, the intensity of the symptoms varying according to the amount taken.

The action of rennet, G. LÖRCHER (*Arch. Physiol. [Pflüger], 69, No. 3-4, pp. 141-198*).—This article details over 50 experiments on the effect of various chemicals, heat, etc., on the action of rennet in curdling milk; studies on rennet zymogen, etc. The author describes the method of preparing the rennet. Where a very active rennet is desired which is not to be kept for any length of time the acid extract is recommended; but for securing a preparation which will keep and which is designed for investigating the zymogen and the enzym the glycerin extract is preferred. The effect of a long list of chemicals on the curdling of milk by rennet was studied. These included various salts of potassium and sodium, of the alkaline earths, magnesium, aluminum, zinc, cadmium, and barium. Special experiments were made on the effect of common salt. The effect of solutions of various strengths were studied. The literature of this part of the subject is reviewed and the method of work is given.

The salts of potash and soda nearly all had a greater or less disadvantageous effect on the curdling. Sodium hydrate and potassium hydrate had the greatest effect in retarding the curdling, followed by sodium fluorid and potassium oxalate. The retarding action of the carbonates and bicarbonates was somewhat weaker, and these were followed in order by the sulphates and nitrates, which in quite concentrated solutions did not prevent curdling. Lithium chlorid formed an exception, in that in certain concentrations it slightly accelerated the action of rennet. The salts of sodium and potassium in like molecular quantities differed very little in their action on rennet, although in concentrated solutions the potash salts were on the average somewhat the more injurious.

Unlike the salts of the alkali metals the salts of the alkaline earths materially accelerated the rennet curdling. Calcium hydrate and barium hydrate were disadvantageous on account of their alkaline action. The various salts of magnesium, zinc, cadmium, and aluminum in medium concentration were on the whole more frequently beneficial than injurious.

A number of experiments on the effect of common salt used in different proportions in normal and watered milk showed that salt accelerated the curdling in milk strongly diluted with water, although this action was not uniform in the case of different milks diluted to the same extent. The reason for this the author was unable to determine, although it is suggested as probably due to the difference in the salt content of different samples of milk.

In further experiments on the specific effect of calcium chlorid it was found that the curdling was more rapid and the amount of curd formed during the process of rennet curdling was greater the more lime salt the milk contained and the longer it was allowed to act. Both the transformation of the casein by rennet and the union of the paracasein and lime salts require time; and both of these processes go on more rapidly when they take place simultaneously than separately. The experiments did not determine whether the accelerating action of the lime salts was due alone to the precipitation of the paracasein or whether the lime salts accelerated the transformation of the casein by rennet.

Alkali was found to decompose rennet, and decomposition was more rapid and complete the weaker the rennet solution, the more concentrated the alkali, and the longer it acted. The action of acids on rennet was found to be very similar to that of alkali.

As to the effect of temperature it was found that boiled milk curdled more slowly than raw milk; that an acid reaction increased the resistance of rennet to temperature; that solutions of rennet in glycerin were more resistant to a high temperature than aqueous solutions; that rennet curdling is possible between 10° and 50 to 60°; and that the rennet enzym in medium concentration is destroyed by heating for 10 minutes at 60 to 70° C. Finally, it was found that the rennet of frogs was more active at low temperatures than that of man and calves, although at medium temperatures the latter was the more active.

Concerning the relation between the amount of rennet and the time of curdling it was found that these were proportional only within narrow limits, and that, in general, where large quantities of rennet were used the curdling took place more slowly.

The remainder of the experiments related to studies of rennet zymogen, the amount of rennet in the lining of the stomach under different conditions of nutrition, etc. The results are briefly summed up as follows: The content of rennet enzym in the lining of the stomach is very low in both fasting and digesting animals, but is greater in the case of fasting animals. The content of zymogen is considerable, whether the animal is fasting or digesting food.

Tainted or defective milks, their cause and methods of prevention, H. L. RUSSELL (*Wisconsin Sta. Bul. 62, pp. 27, figs. 10*).—In this bulletin the author treats in a popular manner the established facts relating to the cause, nature, and prevention of taints. Taints are divided under two general heads—(1) those produced by living organisms, and (2) those due to the absorption of odors or to the derangement of the normal functions of the animal. By way of introduction, the bacteria of milk, the manner in which they get into milk, effect of temperature on their growth, etc., are discussed in a quite general way. Following this various specific fermentations, causing taints in milk and cheese, are described and illustrated. The direct absorption of taints before and after milking, the discrimination between directly absorbed and biogenic taints, treatment of tainted milk, and the method of eliminating taints are treated in logical order. In conclusion, a valuable list of suggestions is given for producers in regard to the care of milk, covering the care of animals, milking, storage and transportation of milk, and care of utensils.

"In caring for milk it should be remembered that two things are necessary:

"(1) To prevent the absorption of any foul odors.

"(2) To prevent the development of living organisms in the milk that are able to form foul substances that taint the same.

"The first can be accomplished by keeping taint-producing feeds from the cow and by keeping the milk in a place that is free from all undesirable odors. The second result can be attained by thorough cleanliness combined with a low temperature."

Government aid to dairying in Denmark, B. BÖGGILD (*Ugeskr. Landm., 42 (1897), Nos. 28, pp. 361–364; 29, pp. 376–379*).

Milk: Its decomposition and preservation, R. R. DINWIDDIE (*Arkansas Sta. Rpt. 1897, pp. 49–77, pls. 3, figs. 3*).—A reprint of Bulletin 45 of the station (E. S. R., 9, p. 689).

Bacteria and the dairy, C. E. MARSHALL (*Michigan Sta. Bul. 146, pp. 19*).—A popular bulletin on this subject, treating of the fermentations of milk, means of infection, use of pure cultures, etc.

Annual report of the office for chemical examinations in Breslau (*Abs. in Milch Ztg., 26 (1897), No. 35, pp. 558–560*).—During the year 340 samples of butter were examined, of which 34, or 9 per cent, were regarded as suspicious, usually on account of high water content, high salt content, or being in a spoiled condition. The standard fixed for the city since 1896 has been not over 3 per cent of salt, 15 per cent of water, and in doubtful cases at least 80 per cent of fat. It is believed that normal butter should not contain more than 15 per cent of water. The analyses are given of a number of samples of butter with a high salt content, with a high water content, or suspected of being in a spoiled condition or adulterated with oleomargarin. In a number of cases the salt content was over 8 per cent and in one instance it was 13.5 per cent. Four cases are given in which the water content was over 30 per cent, being 48.5 per cent in one case.

Tests were made of the Gerber milk test for determining the fat content of butter. It was found that the test was fairly accurate, but could hardly be relied on for more than a preliminary test, and the determination of water in a calibrated tube was preferred, together with the test of the behavior of the sample on melting, *i. e.*, the so-called Bischoff's test (E. S. R., 8, p. 25).

Report of the Nuremberg municipal laboratory for the examination of foods and condiments during 1896 (*Milch Ztg., 26 (1897), No. 41, p. 653*).—The part of the report cited has to do with the control of milk and butter. In 11 cases the milk appeared to be skimmed, but the low fat content was found to be due to the fact that the milk from the first part of the milking was placed upon the market, while that from the last part was used for feeding calves. The author emphasizes the necessity for a legal definition of whole milk.

The average of the analyses of 333 samples of normal milk is given as follows: Specific gravity 1.0319, total solids 12.91 per cent, and fat 3.90 per cent. The composition of 32 samples of butter examined during the year is given as follows:

Composition of butter in Nuremberg.

	Degree of acidity of butter.	Degree of acidity of butter fat.	Water content.	Fat content.	Köttstorfer saponification number
			Per cent.	Per cent.	
Maximum	11.80	12.30	21.74	86.50	228.2
Minimum	3.60	1.40	12.00	76.70	220.2
Average	5.70	4.42	15.54	83.66	225.8

Report of the hygienic institute on food control in Hamburg to 1896, inclusive, DUNBAR and FARNSTEINER (*Milch Ztg., 26 (1897), No. 35, pp. 552–554*).—The parts of the report noted have to do with the control of dairy products, especially milk and butter. The average water content found for 292 samples of creamery butter was 13 per cent, and 91 per cent of the samples contained less than 16 per cent of water. Of 819 samples of tub butter or butter of unknown origin, 348 samples contained 16 per cent or less of water, 138 contained from 16 to 19 per cent, 319 contained from 19 to 28 per cent, and 14 contained over 28 per cent of water.

The question is discussed of the allowable amount of water in tub butter. In Hamburg the limits fixed are 16 per cent of water for creamery butter and up to 19 per cent for tub butter. It is stated that in tub butter containing a high percentage of water, oleomargarin, peanut oil, etc., are added to the butter to prevent the water from separating out on keeping. Borax and "starch sirup" (glucose) are also said to be frequently added to butter to hold water which has been worked into it.

Milk and dairy inspection, M. P. RAVENEL (*Pennsylvania Dept. Agr. Rpt. 1896, pp. 447–457*).—The danger of transmission of disease through milk is pointed out by numerous citations, and an appeal is made for dairy inspection.

VETERINARY SCIENCE AND PRACTICE.

The contest against bovine tuberculosis, B. BANG (*Ugeskr. Landm., 43 (1897), Nos. 44, pp. 485–489; 45, pp. 599–601*).—An address delivered at the Agricultural Congress held in Stockholm in July, 1897.

Since 1893 extensive trials have been conducted in Denmark by the author for the prevention of tuberculosis by means of the tuberculin test, isolation of healthy and of diseased animals, and feeding of calves with boiled milk, etc. The summary tables given show that 5,733 herds have been tested, containing in all 158,991 animals, or about 5 per cent of the total number of cattle in the country. Twelve hundred and seventy-four herds, or 22 per cent, were found healthy at the first inoculation. Of the total number of animals tested, 48,955, or 31 per cent, reacted. The author finds, however, that the percentage of reacting animals is on the decrease, being, in 1894, 40 per cent; in 1895, 38.7 per cent; and in 1896–'97, 31 per cent. The extent of tuberculosis among animals of different ages was found to be as follows:

Tuberculosis in animals of different ages.

Age.	Healthy.	Reacting.	Per cent reacting.
Under one-half year	22,109	2,989	11.9
About one year	28,178	8,328	22.8
About two years	15,976	7,862	33.0
Full-grown cattle	43,773	29,776	40.5

The measures recommended by the author for the eradication of bovine tuberculosis are summarized below:

"(1) To ascertain the actual distribution of the disease in the herd.

"(2) To isolate the diseased from the healthy animals so far as possible, and to thoroughly disinfect the stable where the latter are to be placed.

"(3) To see to it that the healthy calves are not infected through the food (milk).

"(4) Remove the plainly tuberculous (far-gone cases) from the herd by selling them for meat as soon as possible.

"(5) If the number of reacting animals is small, it may be best to remove all of them from the herd. Otherwise they are kept so long as they do not show clinical signs of tuberculosis, and used as milch cows as heretofore. They must, however, be watched closely to observe in time in case tuberculosis of the udder should develop or the tuberculosis on the whole should progress appreciably.

"(6) The calves of reacting animals, unless these show symptoms of advanced tuberculosis, are also kept, but they are immediately after calving removed from the infected stable to a calf barn, or if there is no such building to the healthy division. The calves are allowed the colostrum milk of the dam the first day, but from the second day on only boiled milk (or milk heated to 85° C.) or otherwise milk of perfectly healthy cows."

—F. W. WOLL.

The contest against tuberculosis of cattle, O. VOGES (*Der Kampf gegen die Tuberculose des Rindviehs, 1897, pp. 82*).—This is a lengthy popular essay on the subject of tuberculosis in which the difficulties of dealing with it are brought out and the legal enforcement of a plan of extermination similar to that of Bang in Denmark advocated for the German Empire. The enforcement of such a plan for 5 years it is thought would very effectually eradicate the disease. The use of tuberculin is very highly commended. The difficulties that arise in its use, such as have been learned from its use in America, are not brought out.

Referring to the subject of inheritance of tuberculosis, it is shown that so far as anatomical evidence is concerned, of 1,000,000 calves butchered in Munich only 5 were evidently born with tuberculosis. Of 170,000 calves killed at Berlin during the years 1885 to 1887 only 13 were tuberculous, while of 230,000 killed in Ogsburg between 1873 and 1886, inclusive, only 9 were found diseased; while of 370,000 killed in Prussia during 1888 and 1889 only 73 were found to be tuberculous. This amounts to 1 case of inherited tuberculosis in 196,666 calves. Bang's tuberculin experiments, the results of which indicate a much larger percentage of inherited tuberculosis than is here reported, are also noted.

The positive inability to definitely determine whether an animal is tuberculous, without dividing the whole animal up into sections of microscopic thinness and making a microscopic study of the same, is pointed out.

Hog cholera and swine plague, W. B. NILES (*Iowa Sta. Bul. 35, pp. 769–780*).—A popular article on these diseases, with suggestions for their prevention, etc. Attention is called to the difficulty of diagnosing. The author is of opinion that when a large number of swine die in a neighborhood they are attacked by either the one or the other of the 2 diseases.

The contagious character of the diseases, means of spreading, etc., are discussed, and the popular notion that they are due to feeding new corn is controverted. Keeping an animal in vigorous health by the observance of hygienic rules will render it to a certain extent less liable to any disease, but it will not render it immune against these swine epizootics. Bad sanitation the author considers to be of greater assistance in spreading the disease than all other causes. As to the remedies, the author asserts that the reputation gained by cholera compounds has been gained when the animal would have recovered without any treatment. "A purgative at the outset of the disease, followed by some antiseptic like carbolic acid or hyposulphite of soda, will give as good results as anything."

Preventive measures are more important. Objection is raised to the inoculation method of Billings et al., that the disease is apt to be spread as well as cured. The serum method it is thought will be of much service if it proves practicable, but the method of mixing the serum with the virus, as has been done in some recent experiments, seems to be open to the same objection as the older methods of inoculation.

The author is of the opinion that much more could be done by the swine owners themselves. The most essential measure is the exclusion of all sources of contagion. To accomplish this all swine bought for feeding or breeding purposes should be quarantined for at least 30 days before being placed with the herd, and the water supply carefully looked after, that from deep wells being preferable.

"After the disease appears something can be accomplished by separating the herd into small bunches kept some distance apart, by cremating the dead, and by disinfecting the yards and pens by the free use of lime or crude carbolic acid. If the farm is restocked with swine, new yards should be provided. . . .

"If every swine raiser would remember the main facts, viz, that the disease is communicable, occurring only as the result of the presence of the cholera or swine plague germ; that the sick or exposed hog is the usual carrier of the virus, that the disease is incurable, and should then do the best he can to exercise the necessary precautions to prevent disease reaching his premises, the great annual loss would be very greatly reduced."

Diseases of sheep observed in Iowa, W. B. NILES (*Iowa Sta. Bul. 35, pp. 781–819, figs. 10*).—The location of diseased flocks in the State was determined by means of a circular letter addressed to persons engaged in the sheep industry. Most of the diseases observed were found to be largely due to parasites. The author describes more or less in detail in a popular manner, giving appropriate remedies, the following: The sheep tick (*Melophagus ovinus*), the scab mite (*Psoroptes communis*), which seems not to be widespread and at present confined to a few farms; the sheep gadfly or bot fly (*Œstrus ovis*), the stomach worm (*Strongylus contortus*), which in 1896 caused more loss than all other sheep affections combined and seems to be rapidly becoming more widely disseminated over the State; *Œsophagostoma columbianum*, which is very common in Iowa; *Tænia cœnurus; T. expansa*, which is very prevalent in Iowa; *Trichocephalus affinis*, which is somewhat common; lung worms; foot rot; actinomycosis; infectious abortion, and louping ill.

Diseases supposed to be the louping ill were reported, but careful consideration leads the author to believe that there was a mistake in identification and that louping ill does not occur in the State.

Cases of poisoning from rape-seed cakes, B. BANG (*Ugeskr. Landm., 43 (1897), Nos. 44, pp. 589–591; 45, pp. 604, 605*).—About 20 cows of a herd of 77 head were made sick by feeding a lot of French rape-seed cake, and 9 died. Two cows fed experimentally with 3 and 4 lbs., respectively, of the meal soaked in water had colic and died within 12 hours. The effect was attributed to the presence of large quantities of mustard oil in the oil cake, 0.56 per cent being found. A similar poisoning case is on record from Belgium. Fed in small quantities, not to exceed 2 lbs. per head daily, the cake did not seem to produce any injurious effect.—F. W. WOLL.

Animal parasites of Nebraska, H. B. WARD (*Nebraska State Bd. Agr. Rpt. 1896, pp. 173–189, figs. 12*).—*Statistical studies of Nebraska parasites* (pp. 173–180).—Twenty dogs and an equal number of cats were examined and the former found to be parasitized to the extent of 75 per cent. Of these 15 per cent were infected with 1 species, 40 per cent with 2, and 20 per cent with 3. Twenty per cent were only slightly and 20 per cent were badly infected. The species of parasites found and the number of animals infected by them were *Tænia marginata*, 1;

T. serrata, 9; *T. serialis*, 1; *Dipylidium caninum*, 13; *Ascaris mystax*, 4; *Uncinaria trigonocephala*, 2; and *Echinorhynchus* sp. (?), 1. These results are compared with some obtained in other parts of the world, and American dogs shown to be very badly affected. This is due to the large number of *Tænia serrata* and *Dipylidium caninum* harbored. These two forms are relatively much more abundant here than in any other country. The parasites found most abundantly in the dog come from the rabbit.

Of the 20 cats examined all but one were infected with from 1 to 4 species of parasites. Thirteen were only slightly and 3 were badly infected; 5 contained *T. crassicollis*, 3 *Dipylidium caninum*, 6 *Distoma felineum*, 14 *Ascaris mystax*, and 5 *Uncinaria trigonocephala*.

A comparison of the tables given by the author shows that the cats were not so badly affected as the dogs. The largest total number of parasites collected from any cat was less than 60, while 4 dogs were found which contained from 200 to 500 each. The Distomid was found in large numbers, and, on account of the difficulty of being sure in cases apparently free from this parasite it may have been much more abundant than the figures show.

Besides the dogs and cats, 162 chickens, 9 ducks, 56 turkeys, and 1 goose were examined. Sixty chickens, 2 turkeys, and the goose were found to be affected. Cestodes were found in 14 per cent of the chickens and 4 per cent of the turkeys; nematodes in 26 per cent of the chickens and in the goose.

Parasites new to Nebraska (pp. 180–189).—In this section there is given a general description of *Tænia confusa*, a new human tapeworm, of which a detailed description is in preparation. In some respects this parasite appears to be intermediate between the pork tapeworm, *T. solium*, and the beef tapeworm, *T. saginata*. It has the slender appearance and delicate structure of the former, while its segments are larger than those of the latter. So far 2 specimens have been found, only 1 of which had the head in position. The other specimen measured some 500 cm. in length.

Another species, *T. serialis*, found in the small intestine of the dog and listed in the former report as *T. cænurus*, later studies show to be the species described by Railliet in 1863.

The rest of the report is devoted to the round worms (*Heterakis perspicillum*), found in chickens, *Uncinara trigonocephala*, and *Sclerostoma equinum*, taken from a horse near Lincoln.

The bacterium of the foot and mouth disease, A. STUTZER and R. HARTLEB (*Arch. Hyg., 1897, No. 4, pp. 372–404*).—The growth upon media of the specific organism causing this disease is described in more or less detail, together with inoculation experiments on mice and guinea pigs. It is shown that the organism varies its form according to the media in which it is grown. Sometimes it appears as oval rods scarcely $1\frac{1}{2}$ times as long as it is broad. Under some conditions it appears as a coccus, a diplococcus, or streptococcus, while under other conditions it may appear as a staphylococcus, or even a filiform fungus. The author notes that former investigators have not sufficiently recognized the very considerable power of change of form that the organism possesses. The essential difficulty, which needs further study, is not the morphology but the physiology of the organism.

Circulars of the live stock sanitary board (*Pennsylvania Dept. Agr. Rpt. 1896, pp. 432–447*).—Four circulars on directions for inspecting herds for tuberculosis, for disinfecting stables, and on precautions and measures to be observed to prevent the reintroduction and redevelopment of tuberculosis in inspected herds and questions and popular answers relating to tuberculosis in cattle.

Report on rabies in central Pennsylvania, U. G. HOUCK (*Pennsylvania Dept. Agr. Rpt. 1896, pp. 458–465*).—A more or less detailed account is given of attacks of rabies, in several cases embracing dogs, cows, horses, and man.

A summary of clinical bacteriology, R. WURTZ (*Précis de Bacteriologie Clinique. Paris: Masson et Cie., pp. 544, figs. 57*).—This is a laboratory compendium for the worker in clinical bacteriology. A description is given of material and of local manifestations of infectious diseases, their bacteriology and the general bacteriology of microbic diseases discussed.

A revision of the adult tapeworms of hares and rabbits, C. W. STILES (*Proc. U. S. Nat. Mus., 19 (1896) pp. 145–235, pls. 26; abs. in Zool. Centbl., 4 (1897), No. 18–19, pp. 617–619*).—Analytical keys and specific descriptions are given. The author is disposed to recommend that type specimens should be deposited in the U. S. National Museum and that they should be preserved as balsam mounts. The known leporine cestodes belong to 5 genera: Anoplocephala, Andrya, Bertia, Cittotænia, and Davinea. The first and the last two are thought to be perfectly valid. The second and third are thought to be of uncertain validity, although the author is of the impression that they will finally prove to be valid. In the future more attention must be paid to minute anatomical details in determining genera and species and the principle of homoplasy must be recognized.

Embedding tissue without hardening in alcohol, A. DOLLKEN (*Ztsch. Nuki., 14 (1897), pp. 32–35; abst. in Jour. Roy. Micros. Soc. [London], 1897, No. 5, pp. 448, 449*).—Where animal or vegetable tissues contain substances soluble in alcohol or ether and thin sections are needed, they may be fixed in chrome-osmium acetic acid and in picric acid solution, after which they may be embedded in gum and exposed for 24 hours to the action of aceton vapor at ordinary temperature. Thinner sections than those obtainable by this method may be obtained according to the following method: Small pieces of tissue fixed in 10 to 20 per cent formalin are placed in a capsule to which some resorcin and glycerin are added. The mass stiffens in a short time and is capable of being sectioned in a few hours. It may be fixed to the block of the microtome with water glass or syndetikon, and should be sectioned at once, as it soon becomes very hard.

The author also obtained good results by embedding in soap made as follows: Castor oil or stearic acid, with 20 to 30 per cent of caustic soda, is boiled for a while, and, after cooling the alkali, removed by pressure, dilution, or by frequently dissolving the soap. A piece of tissue about 1 cc. high is transferred from the formalin to a 3 to 5 per cent solution of soap made with distilled water, and allowed to remain in it 36 to 72 hours in a covered vessel. Solidification is brought about by evaporation or by means of powdered Glauber salts. The block is then fixed to the microtome with water glass and the sections are cut dry. They roll somewhat, but may be straightened in water. The soap must be washed out before staining. The addition of 5 cc. of glycerin and of alcohol to each 55 cc. of the soap solution greatly aids in orientation.

AGRICULTURAL ENGINEERING.

Influence of width of tire on draft of wagon, H. J. WATERS (*Missouri Sta. Bul. 39, pp. 165–206, figs. 14*).—Experiments on this subject are reported in detail, with numerous figures and diagrams. The results are summarized as follows:

"Numerous tests of the draft of wide and narrow tired wagons have been made at this station during the past two years on macadam, gravel, and dirt roads, in all conditions, and on meadows, pastures, and plowed fields, both wet and dry. The draft has been determined by means of a self-recording dynamometer. The net load was in every trial the same, viz, 2,000 lbs. Contrary to public expectation, in a large majority of cases the draft was materially less when tires 6 in. in width were used than when the tests were made with tires of standard width—1½ in. The following is a summary of the results:

"(1) On macadam street, as an average of the 2 trials made, a load of 2,518 lbs. could have been hauled on the broad tires with the same draft that a load of 2,000 lbs. required on the narrow tires.

"(2) Gravel road. In all conditions of the gravel road, except wet and sloppy on top, the draft of the broad-tired wagon was very much less than that of the narrow-tired wagon. Averaging the 6 trials, a load of 2,482 lbs. could be hauled on the broad tires with the same draft required for a load of 2,000 lbs. on the narrow tires.

"(3) Dirt roads. (*a*) When dry, hard, and free from ruts and dust 2,530 lbs. could have been hauled on the broad tires with the same draft required for 2,000 lbs. on the narrow tires. (*b*) When the surface was covered with 2 or 3 in. of very dry, loose dust, the results were unfavorable to the broad tire. The dust on the road in each of these trials was unusually deep. (*c*) On clay road, muddy and sticky on the surface and firm underneath, the results were uniformly unfavorable to the broad tires. (*d*) On clay road, with mud deep and drying on top or dry on top and spongy underneath, a large number of tests showed uniformly favorable to the broad tire. The difference amounted to from 52 to 61 per cent, or about 3,200 lbs. could have been hauled on the broad tires with the same draft required to draw 2,000 lbs. on the narrow tires. In this condition of road the broad tires show to their greatest advantage. As the road dries and becomes firmer, the difference between the draft of the broad and narrow tires gradually diminishes until it reaches about 25 to 30 per cent on dry, hard, smooth dirt, gravel, or macadam road, in favor of the broad tire. On the other hand, as the mud becomes softer and deeper, the difference between the draft of the 2 types of wagons rapidly diminishes until the condition is reached when the mud adheres to both sets of wheels; here the advantage of the broad tire ceases entirely, and the narrow tires pull materially lighter. (*e*) Clay road, surface dry, with deep ruts cut by the narrow tires in the ordinary use of the road. In every trial the first run of the broad tire over the narrow-tire ruts has shown a material increased draft when compared with that of the narrow tire run in its own rut. The second run of the broad tires in the same track, where the rut is not deep, completely eliminated this disadvantage, and showed a lighter draft for the broad tire than the narrow tire showed in the first run. Where the ruts were 8 in. deep, with rigid walls, 3 runs of the broad tire in its own track over the ruts were required to eliminate the disadvantage. Three runs of the broad tire over this track have in all cases been sufficient, however, to so improve the road surface that both the broad and narrow-tired wagons passed over this road with less draft than the narrow tires did in the original ruts. In addition to the saving or draft, the road was made very much more comfortable and pleasant for the users of light vehicles and pleasure carriages by the few runs of the 6-in. tire. Summing up all the tests on dirt roads, it appears that there are but three conditions on which the broad tires draw heavier than the narrow tires, viz: (1) When the road is sloppy, muddy, or sticky on the surface, and firm or hard underneath. (2) When the surface is covered with a very deep loose dust and hard underneath. (3) When the mud is very deep and so sticky that it adheres to the wheels of both kinds of wagons. It appears that the dust must be extraordinarily deep to show a higher draft for the broad than for the narrow tires. The three conditions just named, therefore, are somewhat unusual and of comparatively short duration. Through a majority of days in the year and at times when the dirt roads are most used and when their use is most imperative, the broad-tired wagons pull materially lighter than the narrow-tired wagons.

"(4) A large number of tests on meadows, pastures, stubble land, corn ground, and plowed ground in every condition, from dry, hard, and firm to very wet and soft, show without a single exception a large difference in draft in favor of the broad tires. This difference ranged from 17 to 120 per cent.

"(5) It appears that 6 in. is the best width of tire for a combination farm and road wagon, and that both axles should be the same length, so that the front and hind wheels will run in the same track."

Experiment farm barn well suited for animal comforts, F. E. EMERY (*North Carolina Sta. Bul. 143, pp. 188-190, fig. 1*).—The experiment station barn, with its attached shed, is described, and observations on the temperature inside and outside of the barn during 1895 and 1896 are reported. The records show a wider range of temperature outside than inside the stable, "but when comparisons are made of the mean monthly temperatures the greater range is found to have averaged much nearer the average stable record than might have been expected. The stable averages warmer for the winter half of the year and cooler during the summer half."

STATISTICS—MISCELLANEOUS.

Tenth Annual Report of Arkansas Station, 1897 (*Arkansas Sta. Rpt. 1897, pp. 7, Append. pp. 140*).—Organization list, brief report by the director on the bulletins issued and the general work of the year, and a financial statement for the fiscal year ending June 30, 1897. The appendix is made up of reprints of Bulletins 44–48 of the station.

Ninth Annual Report of New York Cornell Station, 1896 (*New York Cornell Sta. Rpt. 1896, pp. 3-34, Append. pp. 35-622*).—Brief reports by the director and heads of departments on the work of the year, subject list of bulletins published since the organization of the station and text of the Federal law under which the station was organized. The appendix contains reprints of Bulletins 106–123 of the station, indexes of illustrations and text, and a detailed statement of receipts and expenditures of the station for the fiscal year ending June 30, 1896.

Tenth Annual Report of New York Cornell Station, 1897 (*New York Cornell Sta. Rpt. 1897, pp. XXI, maps 2; Append. I, pp. 352; II, pp. 353-374; III, pp. 67, figs. 46*).—The report proper consists of a review of the work of the station by the director and heads of the department for the six months ending June 30, 1897. Appendix I is made up of reprints of Bulletins 124–136 of the Station and Circulars 5 and 6, which give suggestions concerning cooperative tillage experiments with potatoes, sugar beets, and fertilizers. Appendix II contains a detailed statement of the receipts and expenditures of the station for the six months ending June 30, 1897, and an index of illustrations and text of the above-noted bulletins. Appendix III is a reprint of Teachers' Leaflets on Nature Study 1–7, dealing with the following subjects, respectively: How a squash plant gets out of the seed, how a candle burns, four apple twigs, a child's garden, some tent makers, what is nature study, and hints on making collections of insects.

Reports of director and treasurer of Rhode Island Station, 1896 (*Rhode Island Sta. Rpt. 1896, pp. 153-172, 370-380, I-XIX, map 1*).—Report of the treasurer for the fiscal year ending June 30, 1896, and a detailed review by the director of the organization and work of the station during the year. Lists of donations, exchanges, and publications of the station since its organization in 1888 are given, together with an index of the report and bulletins of the station for 1896.

Reports of director and treasurer of West Virginia Station, 1896 (*West Virginia Sta. Rpt. 1896, pp. 4–28*).—Includes an account of the purchase and equipment for station use of a farm of 81 acres; notes on the progress and development of the station and on changes in the station staff; subject list of bulletins published by the station since its organization; a detailed financial statement for the fiscal year ending June 30, 1896; and an account of the origin and present status of farmers' institute work within the State.

Our foreign trade in agricultural products during the five fiscal years 1893–'97, F. H. Hitchcock (*U. S. Dept. Agr., Section of Foreign Markets Bul. 10, pp. 38*).—A statistical review of the total and the agricultural exports of this country for these years. The total value of the agricultural exports for 1897 was $689,755,193, a gain of $115,357,929 over the exports for 1896, and more than $50,000,000 greater than any of the four preceding years.

Agricultural imports and exports, 1893–'97, F. H. Hitchcock (*U. S. Dept. Agr., Section of Foreign Markets Circ. 20, pp. 15*).—Tabular data reprinted from U. S. Dept. Agr., Section of Foreign Markets Bulletin 10 (see above).

Agricultural and live stock returns of Colony of Cape of Good Hope for 1896–'97 (*Cape Town, 1897, pp. XXV, 15*).—General notes on the climate and agricultural conditions of the different subdivisions of the colony, with tabulated statistical data on the farm crops sown, lost, and harvested; live stock; vintage; fruit trees and vine stocks planted, etc.

Agricultural and live stock statistics of South Australia, 1896–'97 (*Adelaide, 1897, pp. 72*).

Agricultural statistics for British India for the years 1891–'96 (*Calcutta: Office Supt. Govt. Printing, 1897, pp. 377*).—Tabulated data showing the area and classification; total acreage of crops; live stock; assessment on area and population; extent of tea, coffee, and cinchona cultivation; and estimated area and yield of certain principal crops in each of the provinces and districts of India during the years 1891–'96.

Annual report by the deputy director of agriculture, Bombay presidency, India, 1897 (*Bombay: Govt. Central Press, 1897, pp. 41*).—An account of the cultural, dairying, and breeding operations conducted on the Government experimental farms at Poona and Surat during the year ending March 31, 1897.

The division of land in Danish agriculture (*Ugeskr. Landm., 43 (1897), No. 43, pp. 576, 577*).—Gives statistics of the areas devoted to grain raising, meadows, pastures, truck farming, forests, etc., according to investigations made in 1896.

Export of oranges, season of 1897, J. Stephenson (*Agr. Gaz. New South Wales, 9 (1898), No. 1, pp. 60–63*).—The shipments which have been made to Great Britain of Australian oranges are discussed and suggestions made for conducting the enterprise in future.

Proceedings of the tenth annual session of the State Agricultural Society, held at Lafayette, Louisiana, January 22–24, 1896 (*Baton Rouge, La.: Issued by State Bureau Agr., pp. 118*).—This gives the constitution, act of incorporation, and officers of the society, and reprints of a number of papers read before the society on various agricultural topics.

Teachers' leaflets on nature study (*New York Cornell Col. Agr. Leaflet No. 8, pp. 69–77, figs. 7*).—A popular discussion on the leaves and acorns of our common oaks.

Agricultural extension work—A sketch of its origin and progress (*New York Cornell Sta. Rpt. 1897, pp. 325–333.*)—A reprint of Bulletin 137 of the station (E. S. R., 9, p. 699).

Note filing, L. C. Corbett (*West Virginia Sta. Rpt. 1896, pp. 240–244*).—A new form of notebook designed by the author for use in the field and as a permanent record is described.

NOTES.

INDIANA STATION.—J. M. Barrett, assistant chemist of the station, has resigned to become chemist for the Hammond Packing House, Hammond, Indiana.

NEBRASKA UNIVERSITY.—An association was organized March 10, 1898, to be known as the Agricultural Students' Association of the University of Nebraska. The officers are: President, C. L. Brown; vice-president, F. A. Swanson; secretary, Charles W. Melick. The executive council is composed of the Chancellor of the University, Dean Charles E. Bessey, T. L. Lyon, A. E. Davison, A. L. Haecker, and C. L. Brown. The work of the association will be to carry on cooperative experiments under the direction and supervision of the heads of the following departments: Agriculture, horticulture, botany, chemistry, entomology, and veterinary science. The object of the association is to promote the cause of agricultural education by causing the students to continue at home the study and investigation which they have begun at the university.

NEW JERSEY STATION.—The following changes have been made in the board of managers of the station: Rynier J. Wortendyke, of Jersey City, has been appointed, *vice* Edmund H. Davey, resigned, and Elwood Evans, of Haddonfield, *vice* Isaac W. Nicholson, deceased.

OKLAHOMA COLLEGE AND STATION.—The board of regents has been reorganized as follows: President, R. A. Lowry, Stillwater; Gov. C. M. Barnes, Guthrie, *ex officio;* R. J. Edwards, Oklahoma City; W. F. Bort, Kingfisher; John C. Towsley, El Reno; treasurer, Chas. J. Benson, Shawnee.

NECROLOGY.—Aimé Girard born at Paris December 22, 1830, died in the city of his birth April 12, 1898. His life was devoted to the study of agriculture and rural economy, and agricultural progress in France has been largely due to his efforts. He made valuable contributions to the study of flours, bread, fibers, etc., but probably his best known and most valuable investigations were those relating to the improvement of the sugar beet and the potato and their domestic and commercial uses. In 1887 he published *Recherches sur le développement de la betterave à sucre,* which was followed in 1891 by *Recherches sur la culture de la pomme de terre industrielle et fourragère.* His knowledge of general chemistry and agricultural and industrial technology well adapted him for his work at the Conservatoire des Arts et Métiers, with which he has been connected since 1871. He was the first occupant of the chair of agricultural technology, established in 1876, at the Institut Agronomique. In 1882 he became a member of the National Society of Agriculture, and in 1890 he was made secretary of the Society for the Encouragement of National Industries. He was elected a member of the Academy of Sciences in 1894, to fill a vacancy in the section of Rural Economy.

EXPERIMENT STATION RECORD.

VOL. IX. NO. 11.

In order to establish the rational feeding of man and the domestic animals on a thoroughly scientific basis it is essential that the income and outgo of both matter and energy should be accurately measured. This has led to the development of what are known as metabolism experiments and the devising of special methods and apparatus for such experiments. A digest of the published accounts of metabolism experiments has recently been issued as a bulletin of this Office.[1] The present number of the Record contains a brief abstract of that bulletin (p. 1073), together with an article by one of its authors showing the relation of metabolism experiments to other investigations regarding the food and nutrition of man and animals. A complete metabolism experiment involves a determination of the income and outgo of the various chemical elements, especially nitrogen, carbon, hydrogen, and oxygen, which make up the substance of the animal body or are connected with its life processes, as well as of the physical factors involved in the income and outgo of energy. A few brief statements regarding the present status of this subject may serve to indicate its importance and show what remains to be done to work out these problems.

In respiration experiments which have been made in the past the income and outgo of nitrogen and carbon have been successfully measured. The determination of hydrogen has, however, been far from satisfactory. This fact, among others, was brought out in the compilation of experiments with man and animals above referred to. The correctness of such determination depends upon the accuracy of the measurements of water in the respiratory products. The usual plan followed has been to analyze only aliquot portions of the respired air. Some difficulty has been experienced in the accurate measurement of the samples and of the total amount of air. Although the greater part of the water can be easily determined, a satisfactory determination of the total amount has been difficult of accomplishment. All these factors render the measurement of hydrogen a difficult matter. In connection with work on the respiration calorimeter the Storrs Experiment Station, in its investigations carried on in cooperation with Wesleyan University and this Department, has devised a method for determining the water in respiratory products with the desired accuracy. Reference has been made to the method in previous publications,[2]

[1] U. S. Dept. Agr., Office of Experiment Stations Bul. 45.

[2] U. S. Dept. Agr., Office of Experiment Stations Bul. 44.

although the results which have been obtained are not yet published in full.

The measurement of the income and outgo of chlorin, phosphorus, sulphur, and other mineral matters can be accomplished without great difficulty, although it involves considerable labor. In order to establish a complete balance of income and outgo of material in addition to the other factors enumerated the measurement of oxygen is necessary. This was attempted by Regnault and Reiset. Their apparatus and methods have been elaborated and improved by Rosenthal at Erlangen. Investigations with this improved apparatus are about to be undertaken in connection with the nutrition investigations of this Department.

The determination of oxygen would be of value in many ways aside from its theoretical importance. For instance, at present it is not possible to judge absolutely of the gain or loss of protein and fat in the body, although these factors may be approximately determined. If, however, the income and outgo of oxygen was measured, in addition to the determinations now made, the gain or loss of protein, fat, carbohydrates, and water could be accurately determined. These and other deductions which would be possible would be of special interest in such subjects as the following: Feeding for fat and lean; relation of food to fattening of animals; feeding for milk; relation of food to muscular work, and, in general, the foundation of the laws of nutrition, the clearing up of numerous points now uncertain, and the establishment of principles still in doubt.

The determination of the income and outgo of energy is fully as important as the income and outgo of material. One of the important factors in such determination is the heat of combustion of the food and excreta. Brief reference is made to this subject on page 1016. Such determination may be conveniently made with a bomb calorimeter. The form devised by Berthelot has been modified by Hempel and by Atwater. For a number of years the Storrs Station, in cooperation with this Department, has devoted considerable attention, with successful results, to the perfection of the bomb calorimeter and the methods of using it. A few Berthelot calorimeters as modified by Atwater are now in use in this country. Several institutions in the United States also possess Mahler calorimeters. The different forms of calorimeters and the methods employed in calorimetric determinations have been described at length in a previous publication of this Office.[1]

The use of the bomb calorimeter renders possible the measurement of the income of energy and the outgo in the urine and feces. The energy liberated in the form of heat has been successfully measured with the respiration calorimeter devised by Atwater and Rosa, and used in the nutrition investigations of this Department and the Storrs Experiment Station. The results have not yet been published.

[1] U. S. Dept. Agr., Office of Experiment Stations Bul. 21, p. 161.

THE VALUE OF EXPERIMENTS ON THE METABOLISM OF MATTER AND ENERGY.

C. F. Langworthy, Ph. D.,
Office of Experiment Stations.

INTRODUCTION.

The ordinary feeding experiment deals only with the amount and character of the food consumed and its apparent effect, as shown by the amount and character of the growth of the animal or the milk produced. Without disparaging these experiments, which aim at securing practical results in a short time, and which have been very useful in many cases, it is believed that the time has come when more attention should be given by our experiment stations to studying the real cause of the results which are shown by gains in weight and the milk yield. Care is taken to analyze the feeding stuffs used in such experiments, and much stress is laid upon the inaccuracies of the methods of determining the separate constituents of the food. The amount of digestible nutrients in the feeding stuffs used is calculated, and it is assumed that when these feeding stuffs are fed in combination they will be digested in the same proportion as when fed singly or with one other material. But in most of the experiments the processes which are going on in the animal are ignored, and thus an important phase of the subject is neglected. We rely upon the scales and deductions from feeding standards to tell us whether the animal is well nourished on a given ration. When a change of rations is made and the animal makes satisfactory gains on the new ration any beneficial result is credited to the particular feeding stuff substituted. We have, however, no knowledge, particularly in an experiment of short duration, that the animal was not slowly starving on the first ration from its failure to assimilate the amount of nutrients which it was assumed it should digest from the mixed ration, for the body weight of the animal is not a sufficiently sensitive factor and is too subject to changes in the proportions of water of the tissues and in the contents of the alimentary tract to be relied upon solely as the index of the physiological effect.

Metabolism experiments furnish the necessary data for drawing the desired deductions, and it is believed that this line of experimenting is within the reach of many of the stations.

The animal requires food for two purposes: (1) to furnish material for the building and repair of tissue (or the formation of milk), and (2) to supply fuel for heat and energy. Food consists of the nutrients, protein, fat, and carbohydrates, and various mineral salts. In addition to these water is essential, as is also the oxygen from the air. The nutrients are composed of carbon, oxygen, hydrogen, nitrogen, sulphur, phosphorus, potassium, and other elements. Substances composed of these elements undergo numberless changes, synthetical and analytical, in the processes of digestion, assimilation, and respiration. All the manifold changes of matter and energy are covered by the term metabolism. It signifies the transformation of matter and energy in the animal organism. Practically all material which has undergone metabolism (and which is not stored in the body) is excreted in the urine and respiratory products, although the feces contain metabolic products along with undigested residue of the food consumed.

As previously stated, food is required for the building and repair of tissue and as a source of energy. In the young organism growth is the important consideration. The skeletal framework, tissues, organs, and fluids must be formed from materials supplied in the food. The problem of feeding the young animal is entirely different from that of feeding the adult. It has been found that the digestibility of certain foods is more complete by young than by adult animals, and there are other differences equally marked. In this discussion reference is always made to the adult man or animal unless otherwise stated.

Laws of nutrition.[1]—Experiments in metabolism in which the income and outgo of matter and energy are determined depend upon certain fundamental facts. From these facts certain theories of nutrition have been deduced. The more important of these facts and theories follow:

(1) All nitrogen is supplied from the food; that is, no nitrogen is taken from the air.

(2) Nitrogen is excreted only in the urine and feces; that is, no nitrogen is excreted in the gaseous excretory products.[2]

(3) When the animal is supplied with sufficient food the amount of nitrogen excreted in the urine is dependent upon and, under ordinary circumstances, readily adjusts itself to the amount consumed; that is, the amount excreted in the urine becomes approximately the same as that consumed. The greater part of the nitrogen excreted in the urine is in the form of urea. Some is excreted as uric acid (in herbivora as hippuric acid), and a small amount as nitrogen of extractives, etc. There are numerous conditions apparently causing the retention of nitrogen in the body. The gains of nitrogen, however, are small in the adult in health and are seldom long continued. The tendency is toward nitrogen equilibrium.

(4) A certain amount of food material, *i. e.*, protein, fat, and carbohydrates, is required for maintenance. Mineral matter is also essential,

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[1] In the discussion which follows little reference is made to controversial points. The attempt has been made to state theories in accord with the consensus of opinion of the majority of investigators.

[2] The small amount of nitrogen lost in hair, hoofs, etc., or excreted in perspiration and in volatile organic compounds is left out of account.

but little is known regarding the kind and amount necessary. Protein, fat, and carbohydrates all furnish energy, but protein alone furnishes nitrogen. The above statement may be further simplified by saying that a definite amount of nitrogen and energy is essential.

(5) A more abundant ration is required for muscular work, for fattening, and for milk production than for maintenance; that is, gains in weight, milk, and force for muscular power are produced at the expense of nutrients supplied in excess of the amount required for maintenance.

(6) Food supplied in excess of all needs is stored, in part at least, as reserve material. The principal reserve materials, fat and glycogen, contain no nitrogen, but it is reasonably certain that under certain circumstances a small amount of some reserve material containing nitrogen is also stored up.

(7) If no food is supplied or a diet containing no nitrogen is consumed, nitrogen (derived from body tissue) is still excreted in the urine; that is, the animal is living upon its own substance wholly or in part. Under these circumstances the urine and feces contain more nitrogen than the food; that is, the body is losing nitrogen. When the food contains more nitrogen than is needed there is usually, for a time at least, a small gain of nitrogen in the body, *i. e.*, the urine contains less than the food. However, it does not follow that an excess of nitrogen consumed over the amount essential is stored up in the body. As was mentioned above, the body under ordinary circumstances adjusts itself to new conditions and uses up the nitrogen supplied to it, although it is not altogether certain just how this is accomplished. In other words, the body comes into nitrogen equilibrium; that is, the outgo of nitrogen approximates the income. If all disturbing factors could be controlled, it would probably exactly equal the income, but this can not be said with certainty.

If it were not for the fact that the body comes into nitrogen equilibrium with rations containing different amounts of nitrogen, it is evident that it would continue to form muscular tissue, *i. e.*, cell and cell contents, indefinitely on a ration rich in nitrogen; since muscular tissue (including organs and blood) is the portion of the body characterized by nitrogen. Under some conditions of feeding there are undoubtedly small gains in nitrogen, *i. e.*, muscular tissue.[1] But it is a matter of common observation that overfeeding does not produce more lean, though it does produce more fat.

(8) Fat, which is stored as reserve material, is formed from fat and carbohydrates supplied in the food, and doubtless from protein also.

(9) As furnishers of energy the different nutrients may replace each other in approximately the following ratio: Protein : fat : carbohy-

[1] How much of the nitrogen thus stored forms a part of the cell tissue, how much belongs to cell contents, and how much is in circulation in fluids in the body is a question in regard to which opinions differ, and the data for judging this matter are at present inadequate.

drates :: 1 : 2.5 : 1; that is (having the requisite amount of nitrogen, used probably for the repair of tissue or for some vital process less understood, or for both), it is theoretically and within certain limits unimportant which of the nutrients supplies the necessary energy. An abundance of carbohydrates and fat will, within limits, make up for a deficiency of protein; that is to say, the body will get on with a small amount of protein provided a correspondingly large amount of nitrogen-free material is supplied. This is often spoken of as the power of carbohydrates and fat to protect protein.

(10) The nutrients of the food combine in the body with the oxygen of the air and undergo combustion, thus liberating energy for the body.

METABOLISM OF NITROGEN.

Metabolism experiments of the kind here referred to may be divided into four classes: (1) Those which show the amount of nitrogen (with or without ash constituents) consumed in the food and excreted in the urine and feces; (2) those which also account for the carbon (with or without oxygen and hydrogen), known as respiration experiments; (3) those which in addition to the above factors take account of the energy of the food and excretory products as well as the energy of internal and external muscular work and the heat radiated from the body; and (4) those in which the respiratory quotient is determined, *i. e.*, the ratio of carbon dioxid excreted in the breath to oxygen consumed from the air.

The first line of experimenting is much the simplest, as to both apparatus required and manipulation, and it also affords data which are of much importance not only in judging of the metabolism of protein, but also as to the general condition of the animal. In experiments on the metabolism of nitrogen as ordinarily conducted, the nitrogen in the food, urine, and feces is determined. The urine contains nearly all the metabolized nitrogen excreted from the body. Under ordinary conditions the amount in the feces is small. Apparatus has been devised for the collection of the urine. The collection of the feces is a comparatively simple matter. The nitrogen in the urine and feces may be readily determined by the ordinary methods. The sum of the nitrogen in the urine and feces (representing the outgo) subtracted algebraically from the nitrogen in the food (income) shows whether a gain or loss of nitrogen in the body is taking place, *i. e.*, whether or not nitrogen is being retained in the form of increased tissue, reserve material, etc. If the income is greater than the outgo there is a gain of nitrogen in the body; if it is less than the outgo there is a loss; if it is just equal to the outgo, nitrogen equilibrium has been reached. Comparing the income and outgo is often spoken of as determining the nitrogen balance.

Nitrogen metabolism in its relation to feeding experiments.—The feeding experiment as ordinarily made depends upon considerations like those mentioned above (p. 1004). Yet it is doubtless true that few consider the more technical points in making such experiments. In a feeding experiment, as usually conducted, an animal, or in many cases a lot consisting of several animals, is fed for a longer or shorter period a given ration of known composition. The amount consumed and the gain or loss in weight are recorded. Often the cost of the food eaten and the value of the animal at the beginning and end of the test are also noted, to furnish the means of judging of the economical value of the ration. A feeding test is generally preceded by a preliminary period of arbitrary duration during which the ration to be tested is fed, in order that the body may adjust itself to the new ration and during the test proper may be actually living upon the ration tested and not upon material stored from the previous ration. When different foods are compared, either similar animals or lots of animals are fed the selected rations at the same time and under similar conditions, or the different rations are fed to the same animal or lots in different periods, separated by suitable preliminary periods. The two methods are often combined. If the feces are analyzed the data are obtained for determining the digestibility of the food, since it is assumed that the feces consist of the undigested residue of the food eaten. It goes without saying that the feeding experiment is more valuable when the comparative digestibility of the foods tested is also learned. The fact that digestion experiments have increased in number in recent years shows that the station workers fully appreciate this fact. That the collection and analysis of the urine affords additional data for drawing deductions from feeding tests and permits the deduction of other important facts is not recognized, or if recognized is not carried into practice.

Determining the nitrogen balance in connection with the feeding experiment is useful in the following ways:

It may be very helpful as an indication of the proper length of the preliminary feeding period or the time when the feeding experiment proper may begin, since the existence of nitrogen equilibrium implies that so far as nitrogen is concerned the body is living upon the food eaten.

It is also helpful as showing whether the ration is sufficient for the needs of the animal. If it is insufficient the body will lose nitrogen or carbon or both. In long feeding experiments this loss would almost certainly appear in loss of weight and in poorer condition of the animal. But if the period is short a change in weight is not a sufficient indication of the physiological condition, for change in weight is known to be influenced by different water content of the body and other factors.

The feeding standards commonly followed have been deduced from the best data available at the time they were proposed and in general are in accord with the best practice. In some instances the amount of nitrogen proposed was influenced by the amount consumed from the tissue of a fasting animal as shown by the excretion of nitrogen in the urine, since it was assumed that when living on its own tissue the body would live most economically. It is, however, not certain that the best combination of nutrients (protein and nitrogen-free material) has been found and is shown by the feeding standards. For instance, if the ration contains a very large quantity of nitrogen and practically all is excreted in the urine and feces it may be fairly considered as wasteful unless it can be shown that the gains made are enough better to offset the cost of such a ration, for nitrogen is without doubt the expensive nutrient. By better gains is meant that the material gained consists of lean rather than fat, or that the fat and lean are better distributed. Muscle, *i. e.*, lean, contains about 23 per cent of protein (nitrogen multiplied by 6.25) and by this factor the amount of lean may be computed approximately from the gain of nitrogen.

The small gains of nitrogen which are observed in many experiments and which may be due to a variety of causes are often found to be counterbalanced by corresponding losses if the period of observation is long continued. In order that there should be a gain of muscular tissue, of importance from the standpoint of feeding animals for profit, there should be a regular and constant gain of nitrogen of considerable amount. It has been claimed that by special methods of feeding it is possible to cause very considerable increase of gains in muscular tissue. The results of experiments which have been conducted on this line are, however, contradictory. It is not improbable that a system of feeding followed from birth may materially affect the body structure of an animal. Until further observations are made definite statements concerning this question are not warranted.

It is undoubtedly true that different methods of feeding influence the way in which fat is accumulated in the body. It has been claimed that if animals are fattened quickly the fat will accumulate in large masses in certain localities, whereas if the fattening period is of long duration and the fat is accumulated slowly it will be distributed throughout the carcass. The best methods of feeding and the most suitable rations for securing well-distributed fat and lean are not known with certainty. The conditions which influence the constant gain of nitrogen (if this is possible) and hence the gain of lean are not well understood. A consideration of the problem of feeding for lean (whether this be understood to mean feeding so as to insure a better distribution of lean and fat in the carcass or a total gain in muscular tissue) affords one of the most useful investigations in connection with feeding experiments.

As previously stated, determining the gain or loss of nitrogen furnishes data for computing the gain or loss of lean. If it were not for variation in water content of the body as well as in the contents of the alimentary canal the gain or loss of fatty tissue would be shown by subtracting the gain or loss of lean from the total gain or loss, since it is assumed that fat is the only nitrogen-free substance gained in any considerable quantity.

To calculate accurately the gain or loss of fat the balance of income and outgo of carbon must also be known. The measurement of this factor necessitates the use of a respiration apparatus. This will be spoken of later. However, a method[1] for calculating the carbon balance from data furnished by experiments in which the food, urine, and feces have been analyzed has been devised and seems applicable in feeding experiments and experiments on the production of milk.

The length of time a feeding experiment should be continued is shown, in part at least, by determining the nitrogen balance. In the ordinary feeding experiment the proper length of time is largely a matter of conjecture or convenience, the object being to continue the test until the effect of the ration is manifested with certainty. When the nitrogen balance is determined and nitrogen equilibrium is reached and maintained the subject is known to be living upon the tested ration, and continuing the period for a longer time is a matter to be determined by the special question under investigation. For instance, in feeding a certain ration to pigs it is often desirable to learn how long the ration may be profitably fed rather than to study the physiological effect of the ration.

Disturbing conditions will be very readily shown by variations in the nitrogen excretion. If the ration is unvarying and nitrogen equilibrium has been reached the excretion of nitrogen in the urine should be practically uniform from day to day. If this is not the case it is certain that there is a disturbing factor. This would often be undetected in the ordinary feeding experiment, and the fact that there is no certain way of recognizing the presence of disturbing factors when the ration is uniform may account for the fact that contradictory results are so often obtained. In other words, the investigator is not certain that the experimental conditions remain uniform or that they are similar in different experiments. Reaching and maintaining nitrogen equilibrium is an indication that the experiment is progressing regularly, with the experimental conditions under control. This is undoubtedly one of the most important applications of this line of work to feeding experiments.

It is often desirable in the feeding experiment to test some other conditions than rations; for instance, the effect of housing in warm barns. If the special condition studied is sufficient to produce any marked physiological effect it is very probable that this would be shown by variations in the nitrogen balance; that is, a change in the physiological condition would produce a change in the cleavage of protein in the body, and hence in the nitrogen excretion in the urine. Thus, if it should appear in the feeding experiment that drinking large quantities of water increased the excretion of nitrogen in the urine—that is, the cleavage of protein in the body—the deduction would be

[1] Landw. Jahrb., 24 (1895), p. 283 (E. S. R., 7, p. 237); 26 (1897), p. 555 (E. S. R., 9, p. 788).

warranted that the amount of water consumed with a ration should be regulated, unless it was believed to be desirable to furnish large amounts of water. If this were done a correspondingly large amount of nitrogen should also be supplied. If it should appear that the amount of water drunk was without effect on the excretion of nitrogen the conclusion would be warranted that there was no reason for regulating the supply of water.

The manurial value of a ration is an important consideration from an economic standpoint, and this can not be known with certainty unless the nitrogen in the urine and feces is determined.

If feeding tests were made with the additional determinations suggested the results obtained by different observers would be more comparable than is now the case. There is so little proof of uniformity in experimental conditions at present that many of the deductions obtained are only of local or transient interest.

Nitrogen metabolism in its relation to digestion experiments.—What has been said of the value of experiments in which the balance of income and outgo of nitrogen is determined as a control on the accuracy of feeding experiments applies with equal force to digestion experiments. In the digestion experiment, as ordinarily conducted, the animal is fed for a longer or shorter period a definite ration consisting of a single food or combination of foods. The ration is fed until it is assumed the animal is living on it, and then the feces are collected and analyzed. Sometimes various substances, such as powdered cork, bones, or charcoal are given with the last food consumed before and the first food after the digestion experiment proper. These substances impart either a definite consistency or color to the feces and permit the separation of the feces due to the special food under consideration from the feces due to the preceding and following ration. From the composition of the food and feces the coefficients of digestibility are calculated. Unless the balance of income and outgo of nitrogen is determined the time which should elapse after a given diet is consumed before the feces should be collected for analysis is more or less a matter of conjecture, as in experiments with herbivora the feces can not be marked, for instance, with charcoal, as may be done in experiments with man.

It is not known with certainty that the digestibility of food is influenced by the state of nutrition of the subject. It seems reasonable to assume that digestion would be normal under normal conditions; that is, when the body is in nitrogen equilibrium.

It has been sometimes assumed that the feces consist principally of undigested residue, but investigations—some of them comparatively recent—have shown that this supposition is far from correct, and that a considerable percentage of the nitrogen of the feces is metabolized nitrogen derived from bile and other digestive secretions. As previously stated, the nitrogen assimilated from a given diet is largely excreted in the the urine, and, futhermore, it is excreted within a comparatively short time. The nitrogen in the food minus the nitrogen in the feces (which is ordinarily assumed to represent the digested nitrogen) is very nearly the same as the amount excreted in the urine. If the nitrogen of metabolic products in the feces is determined and added to the amount in the urine it is probable that, provided the subject is in nitrogen equilibrium, this sum would more truly represent the total amount of digested nitrogen than the values which are obtained by ordinary methods. At any rate, the values so obtained are useful as a check on the results obtained by taking the difference between food and feces as the amount digested.

In digestion experiments with animals little account is taken of the fact that the digestibility of a food is influenced by the foods which are consumed with it. In experiments with men on an absolute milk diet, a considerable quantity of nitrogen may be excreted in the feces, owing probably to the fact that the milk when consumed in quantity coagulates in the stomach and the masses are not sufficiently broken up in their passage through the intestinal tract so that the digestive juices can act upon the whole mass. On the other hand, if bread is consumed with the milk the particles of bread prevent the formation of large masses of casein in the stomach and the material is in better mechanical condition for digestion, and is actually more thoroughly digested; that is, consuming bread with milk increases the digestibility of the milk. Furthermore, in such experiments it is often impracticable to continue a ration consisting of a single food material for any considerable length of time, because unusual conditions may readily be supposed to eventually produce abnormal results. In all such cases a check on the accuracy of the results is even more valuable than in digestion experiments under normal or usual conditions.

As in the case of feeding experiments, determining the nitrogen balance is useful in showing the regularity of progress of digestion experiments, since if the nitrogen balance does not vary from day to day under like experimental conditions it may be assumed that the experimental conditions are under control, and the results of one investigator may be more readily compared with those of another.

Other experiments in which the nitrogen balance is of use.—There are many other matters connected with the subject of nutrition besides feeding and digestion experiments which need investigation, and are in line with the work followed at many of the stations, in which a determination of the balance of income and outgo of nitrogen is either essential or useful. A proper understanding of the functions of food and the amount of food requisite for different purposes, including the production of work, necessitates a knowledge of the source of energy in the animal body. While it is recognized that energy is supplied by the food, there are many theories as to which of the nutrients is the real source of energy in the body. It is now generally held that protein, fat, and carbohydrates all furnish energy for muscular exertion. Nevertheless, certain prominent investigators urge that this energy is furnished mainly if not entirely by protein. The theory has also been advanced that fat and carbohydrates furnish the energy for moderate muscular work even if long continued, but if the labor is severe the energy for it must be supplied by protein. Many investigators have claimed that muscular work increases the excretion of nitrogen; that is, increases the cleavage of protein in the body. The results obtained are, however, contradictory, and the study of the question of the real source of muscular energy and the effect of muscular work on the cleavage of protein is one which may be advantageously pursued.

Closely connected with the points above noted is the question concerning the time which must elapse before the nitrogen of the food consumed is excreted in the urine. The time which must elapse before the undigested residue of a particular diet is excreted in the feces may be actually determined, since, as noted above, it is possible in many cases to identify the feces by giving them a characteristic color or consistency. There is no such simple means applicable to the urine. It is ordinarily assumed that a comparatively short time elapses before the nitrogen of a particular food is excreted in the urine.

To what extent the nitrogen in the urine is derived directly from the food or to what extent the nitrogen consumed must first form a part of the body tissue before being excreted is a subject on which opinions differ. Whether nitrogen, if stored in the body as reserve material, is stored in nitrogenous cells already formed or whether new cells are built is also a matter on which more information is needed. In skillful hands the data for the intelligent discussion of such problems are furnished, at least in part, by the nitrogen balance. In addition to the determination of the nitrogen balance, the ratio of the different nitrogenous constituents in the urine to each other, and the ratio of phosphorus and sulphur compounds to each other and to nitrogen may be advantageously studied, since these ratios have been shown to vary under different experimental conditions and to furnish a means of judging of the physiological processes going on in the body. In connection with all the work mentioned the elaboration of analytical methods is needed.

Nitrogen metabolism under abnormal or unusual conditions.—The study of nutrition under abnormal, unusual, or pathological conditions is of great importance, since it is true here, as in other branches of science, that the normal can not be known with certainty without a knowledge of the abnormal. As previously stated, metabolism experiments with fasting animals are of use in determining the amount of protein which is actually required. A considerable number of metabolism experiments have been made, in which the subjects (usually men) were massaged. Massage may perhaps be regarded as a form of involuntary muscular exertion, and, while interesting from other standpoints, such experiments are also of use in deducing theories concerning muscular exertion. In other experiments baths of various sorts have been given, in many cases of such a nature that the body temperature was raised. Deductions drawn from these experiments have been of importance in discussions concerning many points. Metabolism experiments with subjects affected with diabetes have been of assistance in studying the functions of fat and carbohydrates, and the ways in which these nutrients are used in the body. Aside from the information they furnish concerning the normal organism, experiments on nutrition in different diseases are of value, considered from a medical stand point. In studying the kind and amount of food best suited to diseased subjects and the influence of disease on digestion and assimilation, and other similar problems, the determination of the balance of income and outgo of nitrogen has been of great assistance.

A number of fundamental facts and theories concerning nutrition were mentioned above (p. 1004). In nearly every instance the conclusions cited were arrived at by the aid of metabolism experiments in which the balance of income and outgo of nitrogen was determined. The line of experimenting which has led to such valuable results in the past can not but prove useful if continued.

METABOLISM OF CARBON.

In the experiments which have been spoken of the balance of income and outgo of nitrogen was the principal factor determined. Many experiments have also been made in which the balance of carbon, with or without hydrogen and oxygen, was determined. These are called respiration experiments, from the fact that the respiratory products are taken into account. Special apparatus is necessary for the collection, measurement, and analysis of the inspired and respired air. This usually includes a respiration chamber in which the subject may remain in comparative comfort for a longer or shorter period. A current of air, sufficient for the needs of the subject, is pumped through the apparatus. In some forms of respiration apparatus, instead of pumping a current of fresh air through the respiration chamber the carbon dioxid produced is removed and fresh oxygen is supplied to take the place of that withdrawn from the air by the subject. The total current is measured and samples of known volume of both the incoming and outgoing air are analyzed. The factors ordinarily determined is carbon dioxid and in some cases water. In experiments with herbivora the methan in the gaseous excretory products is usually determined also, since a considerable quantity of this gas is known to be excreted in the intestinal gases of this class of animals. In these, as in experiments previously mentioned, the food, urine, and feces are analyzed. The usual determinations made are carbon and nitrogen. In some instances oxygen, hydrogen, and mineral matter are also determined.

As the characteristic elements of all foods and the liquid and solid excretory products are nitrogen and carbon, the characteristic element of the gaseous excretory products is carbon. Therefore, if the income and outgo of nitrogen and carbon are determined the data are secured for measuring approximately the total income and outgo of material,[1] since this may be expressed in terms of nitrogen and carbon.

If the amount of carbon consumed in the food is greater than that excreted in the respiratory products, urine, and feces there is a gain of carbon in the organism, and *vice versa.* If carbon is gained it is ordinarily assumed that it is stored in the body in the form of fat, since this is the characteristic carbon compound present in any considerable amount in the body. If the outgo of carbon is greater than the income it is commonly assumed that the food is insufficient and some fat of the body has been utilized. The percentage of carbon in fat is known, and from the gain or loss of carbon the gain or loss of fat can be calculated. As previously stated, the gain or loss of lean can be calculated from the gain or loss of nitrogen, as the percentage of nitrogen in lean meat is also known. These factors, together with the total gain or loss in weight of the subject, furnish data for judging of the physiological effect of a ration and the comparative value of the gains made on different rations.

The source of fat in the animal body is a question which has been much discussed. As already mentioned, the commonly accepted theory is that fat is formed from the excess of fat and carbohydrates consumed in the food. It has been maintained that when an excess of protein is consumed fat may be formed from protein; that is, the protein is broken down in the body into simpler nitrogenous and nitrogen-free substances. While the nitrogen is excreted, some of the carbon is retained and stored in the form of fat. The early experiments which were regarded as proofs of the formation of fat from protein were made with a respiration apparatus. The subject, generally a dog, was fed lean meat, which was assumed to be free from fat and glycogen. All the nitrogen consumed was excreted. Some carbon was retained. The conclusion was therefore drawn that it was retained as fat; that is, that fat had been formed from protein. The discussion of the accuracy of this deduction and the theories based upon it is still going on. The possibility of the formation of fat from protein is rendered probable by experiments of an entirely different nature.[2]

It has been found that muscular work increases the metabolism of carbon; that is, increases the excretion of carbon dioxid in the breath.

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[1] In this discussion no mention has been made of mineral matter. In many experiments the balance of mineral matter has been determined either in terms of total ash or of chlorin, phosphorus, sulphur, etc. Though the mineral constituents of the food are of undoubted importance, their function, aside from the formation of the skeletal framework of the body, is not definitely understood. They undergo little cleavage in the body, and hence are of practically no value as sources of energy.

[2] N. Zuntz, E. S. R., 7, p. 538.

This is often the case when there is no increased excretion of nitrogen and when the nitrogen of the excretory product does not exceed that of the food. In these cases carbon compounds (fat and carbohydrates) must be concerned in the production of muscular energy. It does not necessarily follow that this is true for all forms of energy or for the production of the total muscular energy of the body. It has also been claimed that when work is severe the amount of nitrogen excreted in the urine is increased, or, in other words, protein is broken down to furnish energy for muscular work. The different theories of the source of energy were briefly mentioned above. More investigations are needed before positive deductions can be drawn.

Since the total income and outgo of matter are measured in respiration experiments, the data are available for discussing the conservation of matter in the animal body. Although this would hardly be questioned to-day, the experimental proof of the law as applied to the animal body is not only a matter of abstract scientific interest, but of fundamental biological importance.

What was said of the importance of studying the balance of nitrogen under abnormal or unusual conditions applies with equal force to the metabolism of carbon and of energy.

METABOLISM OF ENERGY.

The previous discussion has been chiefly concerned with only one of the functions of food, namely, supplying the body with material for the building and repair of tissue. Food is also a source of energy. It supplies the body with the necessary heat and energy for internal and external muscular work. The complex compounds consumed in the food possess high potential energy. Before being excreted they are broken down in the body into simpler compounds and part with this energy. The elements unite with the oxygen of the air and undergo combustion in the body.

In ordinary combustion the final products are carbon dioxid, water, and free nitrogen. In the body carbon and hydrogen are also burned to carbon dioxid and water, although the process is not so simple as in the direct oxidation of material in the air. The nitrogen combustion is, however, not so complete, since nitrogen is excreted in the forms of urea and other cleavage products.

It is believed, in accordance with the principle of the conservation of energy, that the amount of potential energy which is transformed into kinetic energy when food is burned in the body is the same as that which would be produced if an equal amount of the same material was burned outside the body. Provided the final products are the same the intermediate steps may be disregarded. Further, in accordance with the principle of maximum work the tendency is toward those changes which result in the greatest evolution of heat or other form of kinetic energy. Accordingly the heats of combustion of the nutrients of food are taken as equivalent to their potential energy, *i. e.*, their value for the production of heat and muscular work when they are burned in the body, due allowance being made for the imperfect combustion of the nitrogenous compounds. The same principle applies to the reserve materials, principally fat and protein, which the body takes from the food and makes part of its tissue before they are burned.

In determining the balance of income and outgo of energy the income is represented by the potential energy of the food. The factors of outgo are the potential energy of the excretory products, the heat radiated by the body, and the amount of muscular work performed. These factors may all be expressed in terms of heat. The data for the balance are usually expressed in units of heat, *i. e.*, calories. The potential energy of the food and excretory products is determined by combustion in a bomb calorimeter or other suitable apparatus. Many different dynamometers have been devised for determining the amount of external work performed. Internal work (expended in chewing, swallowing, and digesting the food, in the beating of the heart, etc.) can not be measured directly, but it is believed that the energy involved in this internal muscular work leaves the body in the form of heat. Therefore this internal muscular work can be measured by determining the heat given off by the body. This requires a special apparatus called a calorimeter. When it is combined with a respiration apparatus of some sort, as has been done in a few cases, it may be called a respiration calorimeter.

In stating the results of experiments in which the balance of energy is studied it is of advantage to compare the energy of the food available for the body—that is, the net income—with the energy liberated by the body. The gross income of the food is represented by its heat of combustion. The net income is the gross income less the heat of combustion of the undigested residue and metabolic products in the feces and the unoxidized material in the urine.

When the balance of income and outgo of energy is determined, if the income exceeds the outgo, energy is stored in the body. It is assumed that this is stored as potential energy in fat, protein, or other reserve material. If the outgo of energy exceeds the income then some of the material of the body has been broken down to liberate this energy.

Calorimetric experiments have a practical application in comparing the energy available to the body from different foods. Further, calorimetric experiments will afford a means for judging of the accuracy of respiration experiments and show more clearly what becomes of the nutrients of the food, the carbohydrates as well as the fat, protein, and extractives. Another application is in the study of the production of work by draft animals. It is evident that the study of these problems necessitates the measurement and comparison of the work performed on different rations. Such experiments are also essential in studying the more general applications of the law of the conservation of energy in the animal body. Although there is no reason to doubt this the experimental proof is a matter of great interest and importance.

Experiments on the income and outgo of energy are comparatively recent. They are very technical and necessitate costly and elaborate apparatus. The results which may be obtained, however, are of extreme importance and their application is widespread. The Connecticut Storrs Experiment Station, in cooperation with this Office, is carrying on elaborate investigations on this matter and it is hoped the work will be enlarged.

THE RESPIRATORY QUOTIENT.

In the respiratory experiments previously mentioned the total income and outgo of carbon was determined. There is another class of respiration experiments in which the total income and outgo is not the factor under consideration, but rather the amount of carbon dioxid excreted in a given time as compared with the amount of oxygen consumed from the air. This ratio of carbon dioxid to oxygen is called the respiratory quotient and experiments in which it is determined may be conveniently called respiratory quotient experiments. For such work special apparatus is needed. In some cases the subject is confined in a chamber not unlike that of the other form of respiration apparatus and the amount of oxygen consumed and carbon dioxid produced is measured. In other cases a tube is inserted in the trachea of the animal. Through this tube all inspired and respired air must pass. The tube is provided with suitable valves, and the incoming and outgoing air is measured, sampled, and analyzed. This device does not cause any serious inconvenience to the animal experimented with. Horses and dogs used in such experiments have lived in health for many years after the operation was performed. In experiments with man and sometimes with animals a mouthpiece or a mask over the head is worn, which, by an arrangement of valves, permits the measurement of the inspired and respired air.

The respiratory quotient varies markedly under different experimental conditions and is a delicate index of the processes going on in the body.

It has been found that protein, fat, and carbohydrates each give a different respiratory quotient when burned in the body. It is therefore possible to judge of the substances actually burned in the body by variations in the respiratory quotient. Muscular work, either internal or external, affects the respiratory quotient, since it increases the amount of carbon metabolized, and hence the carbon dioxid excreted. From the ratio the amount of work performed can be computed. Thus by changes in the respiratory quotient it is possible to measure the energy expended—for instance, in chewing and digesting different foods. This affords a method for determining the actual value of different foods for the body. It is obvious that if two foods have the same composition and digestibility, but one requires twice as much energy for mastication and assimilation, it is only half as valuable for the body as the other.

Very little has been done in America in this line of experimenting. While the work is technical, it is a line the stations can follow to advantage. The results already obtained indicate this to be one of the most promising lines of investigation in nutrition.

CONCLUSIONS.

From what has been said it is obvious that the discovery of the principles and fundamental laws of nutrition rest largely on experiments in which the balance of income and outgo was determined. Some of the points on which more work along these lines should be done have already been pointed out. Thus, more careful comparisons of different feeding stuffs and their value for the production of milk, growth, and force are needed. The formation of fat and the value of different foods for the production of energy, the source of energy in the animal body, the effect of muscular work on the excretion of nitrogen and carbon, and many other questions suggest themselves as lines of work which the stations can advantageously follow. Experiments in which the balance of nitrogen is the principal factor determined require no special apparatus and are comparatively simple. They are therefore the ones which may be most readily undertaken, and, as shown by the value of the results, are of the utmost importance.

The ordinary feeding experiment, in which the amount and composition of the food is determined or calculated and the gains in weight of the animals are recorded, has been of use and will be of undoubted use in the future, but it is limited in its application. Many of the questions which such experiments undertake to settle could be solved by the intelligent farmer working in connection with the stations, and many others can not be definitely solved without making the experiments more thorough.

Contradictory results which are often obtained might be frequently avoided or explained if more were known of the state of nutrition of the animal experimented upon. Experiments to determine such factors are beyond the farmers, and must be carried on by the stations. If the simpler lines of experimenting are left to practical men, who are competent to carry them out on their own farms with their own animals, the time and energy of the trained station workers may be given to more technical matters, which are nevertheless fundamental and of importance from a practical standpoint.

Compilation of metabolism experiments.—In order to work intelligently along these lines the observer must have a knowledge of experimental methods, he must be familiar with the work already done, and be able to draw deductions from the facts observed. Studying the work of other investigators often suggests further lines of experimenting, and by comparison of different investigations errors may be avoided. The literature of metabolism experiments is extensive. Reports of experiments have been published in various scientific journals in many languages. Many of these publications are not generally accessible. More or less extended compilations of results have been made in the past, but in no case so far as known have the individual experiments been cited in detail. Therefore a compilation[1] has been prepared in this Office of experiments with man and animals in which the balance of income and outgo of matter and energy was determined. Some 2,300 experiments with man and about 1,400 experiments with animals have been collected. In a large number the balance of nitrogen with or without mineral matter was the factor determined. In a comparatively large number the balance of carbon, with or without hydrogen and oxygen, was also determined. A still smaller number were calorimetric experiments in which determinations of energy were made. The attempt was not made to include the respiratory quotient experiments, as this forms a subject by itself. In this compilation the food consumed, the length of the experimental period, and the daily or average balance of income and outgo have been quoted in detail. The material has been arranged in convenient form for reference and the tabular matter is supplemented by text in which the experiments are described, and the objects sought, the experimental methods employed, and the conclusions drawn are noted in more or less detail.

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[1] U. S. Dept. Agr., Office of Experiment Stations Bul. 45, "A Digest of Metabolism Experiments."

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

Methods of estimating fat, O. POLIMANTI (*Arch. Physiol.* [*Pflüger*], *70, Nos. 7–8, p. 366*).—In connection with other work the author compared different methods of estimating fat. Extraction with ether by the Soxhlet method did not give satisfactory results. The author found, however, that by shaking finely powdered substances in a shaking machine with ether for two hours all the fat was extracted. Better results were obtained when 2 cc. of metallic quicksilver was added. For instance, 2 gm. of meat meal was shaken with 200 cc. of ether for two hours. The fat was determined in an aliquot portion of the ether solution, and the same amount was obtained as when the same material was extracted for forty-eight hours with a Soxhlet apparatus and afterwards digested and extracted according to Dormeyer's method. Carbon disulphid, petroleum ether, benzol, chloroform, and different mixtures of alcohol and ether were tried, but were found to be inferior to ether as a reagent for extracting fat by the above method.

The lecithin content of certain plant seeds and oil cakes, E. SCHULZE (*Landw. Vers. Stat., 49* (*1897*), *No. 3, pp. 203–214*).—In view of the criticism of the author's method of extracting lecithin, tests of the accuracy of the method were made. The lecithin content of certain plant seeds and oil cakes was determined by the author in connection with E. Steiger and S. Frankfurt. In the author's opinion, the method proposed by him gives satisfactory results provided the substance is finely pulverized before treating it with alcohol. The lecithin content of the seeds and feeding stuffs examined was as follows:

Lecithin content of different seeds and feeding stuffs.

	Lecithin content.[1]		Lecithin content.[1]
	Per cent.		*Per cent.*
Blue lupine	2.19	Hemp	0.73
Do	2.20	Pine	.49
Yellow lupine	1.64	Norway spruce	.27
Vetch	1.09	Fir	.11
Peas	1.05	Peanut cake	.20
Lentil	1.03	Do	.37
Wheat	.43	Sesame cake	.49
Barley	.47	Linseed cake	.44
Maize	.25	Cocoa cake	30
Buckwheat	.53	Cotton-seed cake	.49
Flax	.85		

[1] Calculated from the amount of phosphorus in the ether-alcohol extract.

A considerable quantity of lecithin was prepared from wheat sprouts. This was found to be identical with that obtained from other sources.

A new method for determining crude fiber in foods and feeding stuffs, J. König (*Ztschr. Untersuch. Nahr. u. Genussmtl., 1898, No. 1, p. 3*).—The author states that the Weende method gives altogether too high results, since as high as 40 per cent of the pentoses contained in plants remain undissolved in the crude fiber; and that Schulze's method leaves as high as 30 per cent of the pentoses undissolved. By the use of glycerin containing sulphuric acid the author has obtained results which agree well and are believed to be more accurate. Three grams of air-dry material are mixed in a 500 cc. porcelain dish with 200 cc. of glycerin (1.23 sp. gr.) containing 4 gm. of concentrated sulphuric acid, and heated for one hour in a steam-pressure apparatus at three atmospheres. The contents of the flask are diluted with 200 to 250 cc. of boiling water and filtered while hot on an asbestus filter, the residue being washed with 300 to 400 cc. of boiling water, with 50 cc. of warm alcohol (about 93 per cent), and finally with a warm mixture of alcohol and ether until the filtrate is colorless. The filter and contents are dried and weighed, incinerated, and the difference in weight before and after incineration taken as crude fiber. In the absence of a pressure apparatus the determination can be made in a 600 cc. flask of Schott glass, heating one hour with a reflux condenser at 131 to 133°, *i. e.*, maintaining the glycerin mixture at boiling. The crude fiber obtained by this method is said to contain a maximum of 6.62 per cent of pentoses and 0.1 to 0.4 per cent of nitrogenous substance.

Note on the determination of nitrogen as practiced at the agricultural experiment station of Aisne, France (*Bul. Sta. Agron. Laon, 1897, pp. 58–62, fig. 1*).—The modification of the Kjeldahl method which is used at this station is as follows: To 1 gm. of finely ground material in a 200 cc. flask add a small drop of mercury (about $\frac{1}{2}$ gm.) and 20 cc. of 66° sulphuric acid, and heat on a sand bath until the substance is completely dissolved. This usually requires about half an hour. Then bring gradually to boiling temperature, heating first over a wire gauze, then in the direct flame of the lamp. In about three-quarters of an hour the solution is completely decolorized. Wash the contents of the digestion flask into a liter distillation flask with about 100 cc. of distilled water, add in two portions 100 cc. of caustic soda solution of a density of 1.375 and 5 cc. of a solution of 200 gm. of sodium sulphid in 1 liter of water, then add 15 to 20 gm. of granulated zinc and connect the distillation flask with a bulb tube, the lower arm of which is 1 cm. in diameter and the upper end sharply bent downward to connect with a long tube 4 to 5 mm. in diameter which dips into the flask containing the standard acid. This standard acid contains 35 gm. of pure sulphuric acid per liter, corresponding exactly with 1 centigram of nitrogen. The caustic potash solution used for titrating the acid corresponds, volume for volume, with the acid, thus avoiding the necessity of calculating results.

The Wagner method of determining citrate-soluble phosphoric acid in Thomas slag, B. SJOLLEMA (*Chem. Ztg., 21 (1897), No. 96, pp. 999, 1000*).—The following modification of the citrate method is used: To 50 cc. of the clear filtrate obtained by the Wagner process add 50 cc. of an alkaline citrate solution, prepared by dissolving 500 gm. of citric acid in 4 liters of ammonia of 0.96 specific gravity and making up to 5 liters, and 15 cc. of magnesia mixture each 2 liters of which contain 110 gm. of magnesium chlorid, 140 gm. of ammonia chlorid, and 700 cc. of ammonia of specific gravity 0.96. Shake for ten minutes in a rotary apparatus, allow to stand for two hours or until the following day, and then filter and determine the phosphoric acid in the usual way. The results by this method agree very satisfactorily with those obtained by the Wagner molybdic method. In a few cases the results were too high on account of the separation of silica. This was noted especially in cases where the filtration was particularly slow.

The valuation of phosphatic fertilizers on the basis of their content of citrate-soluble phosphoric acid, P. WAGNER (*Chem. Ztg., 21 (1897), No. 87, pp. 905–911*).—The history of the method of determining citrate-soluble phosphoric acid is traced and the agreement between the results obtained by this method and by experiments with plants is discussed, especial attention being given to the use of the method in determining the fertilizing value of Thomas slag. Experiments are reported which show a uniform and very close agreement between the citrate-solubility of different phosphates, especially Thomas slags, and the actual availability of the phosphoric acid to plants. The precautions which must be observed in order to get concordant results by this method are explained in detail, strict conformity with the letter of the directions being especially emphasized. In a series of tests of the direct citrate method for determining phosphoric acid in the Wagner extract, it was found that unless the freshly prepared extract was used the results were too high in case of slags rich in silica on account of the separation of the silicic acid in the precipitate. The error thus introduced was considerable in case of extracts only two hours old and increased with the age of the extract. If the alkaline citrate solution was added to the fresh extract and the solution shaken, no separation of silicic acid occurred for eight or more hours.

The conclusion drawn from these tests is that in the use of the direct citrate method for determining phosphoric acid in the Wagner extract, a mixture of the alkaline citrate solution and magnesia mixture should be added to the fresh extract, but that the solution may be filtered immediately or it may stand an hour or more after precipitation before filtration without fear of separation of silicic acid. The mixture used should be prepared as follows: Dissolve 200 gm. of citric acid in 1 liter of 20 per cent ammonia. Mix this solution with 1 liter of the ordinary magnesia mixture. The determination of phosphoric acid is made as follows: To 50 cc. of the freshly prepared extract add 50 cc. of the above mixture and shake for one-half hour in a rotary apparatus. Filter at once, or allow to stand not longer than one hour before filtration, and proceed in the usual way.

The determination of citrate-soluble phosphoric acid in Thomas slag, O. BÖTTCHER (*Chem. Ztg., 21* (*1897*), *No. 95, pp. 993–995*).—This is a discussion of Wagner's paper above noted. The author claims priority in pointing out the necessity for precipitation in the fresh extract in order to avoid error due to the separation of silicic acid in the citrate method of determining the phosphoric acid in the Wagner extract. Experimental data are reported to support the claim that Wagner's molybdic method is subject to the same errors due to separation of silicic acid that have been found to affect the accuracy of the citrate method under certain conditions and that the citrate method as modified by the author[1] is reliable when applied to the determination of phosphoric acid in the Wagner extract. It is also claimed that, contrary to Wagner's statement (see above), an error may be introduced by allowing the solution to stand for two hours after precipitation before filtering.

A new method of absolute measurement of gases, O. BLEIER (*Ber. Deut. Chem. Gesell., 30* (*1897*), *No. 19, pp. 3123–3131, figs. 2*).

On an organic phosphorus compound which yields inosite on decomposition, E. WINTERSTEIN (*Ber. Deut. Chem. Gesell., 30* (*1897*), *p. 2299; abs. in Bul. Soc. Chim. Paris, 3. ser., 20* (*1898*), *No. 4, p. 239*).—Along with the proteid substances extracted from cereal grains with a 10 per cent sodium chlorid solution was obtained a compound which contained 13 per cent of magnesium oxid and 42 per cent of phosphoric acid (P_2O_5) and yielded inosite when treated with hydrochloric acid. The exact chemical constitution of the compound was not determined.

Chemical physiological investigation of sugar cane, F. A. F. C. WENT (*Jahrb. Wiss. Bot.* [*Pringsheim*], *31* (*1898*), *No. 3, pp. 289–344, pl. 1*).

Inversion of sugar by neutral salts in the presence of glucose, H. C. PRINSEN-GEERLIGS (*Meded. Proefstat. Suikerriet West Java, 31, pp. 1–12*).

Action of neutral substances on glucose at high temperatures, H. C. PRINSEN-GEERLIGS (*Meded. Proefstat. Suikerriet West Java, 31, pp. 12–17*).

Impure copper sulphate, H. C. PRINSEN-GEERLIGS (*Meded. Proefstat. Suikerriet West Java, 31, pp. 17, 18*).

On the determination of oxygen dissolved in water, ALBERT-LEVY and F. MARBOUTIN (*Bul. Soc. Chim. Paris, 3. ser., 19* (*1898*), *No. 4, pp. 149–151*).

Researches on the rapid determination of manganese in plants and humus soils by a colorimetric method, P. PICHARD (*Compt. Rend. Acad. Sci. Paris, 126* (*1898*), *No. 7, p. 550*).—Incinerate, fuse with potassium or sodium carbonate, add a little dilute nitric acid, place in a test tube with minium or lead bioxid, add a little water and some pure nitric acid, and boil. The presence of manganese will be shown by the rose color of the solution.

A source of error in the Kjeldahl nitrogen determination, T. FREUNDLICH (*Chem. Ztg., 21* (*1897*), *No. 77, p. 781*).—Reports experiments which lead to the conclusion that there is little danger of soda solution being carried over in the process of distillation if the tube fitted in the top of the flask be carried up sufficiently high before it is bent. It is suggested that the neglect of this precaution or the long period of distillation accounts for the errors noted by Sjollema.[2]

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[1] Chem. Ztg., 21 (1897), No. 78, p. 783 (E. S. R., 9, p. 520).

[2] Chem. Ztg., 21 (1897), No. 74, p. 740 (E. S. R., 9, p. 418).

A source of error in the Kjeldahl method of determining nitrogen, W. HOLTSCHMIDT (*Chem. Ztg., 21 (1897), No. 83, p. 871*).—Tests are reported which confirm Sjollema's conclusions regarding the error due to the carrying over of soda in distillation, especially when zinc dust is used instead of granulated zinc.

A method of acidimetry for approximate determinations, R. CIMMINO (*Ann. Ig. Sper., n. ser., 6 (1896), No. 3, pp. 417–423*).

A simple method for detecting the artificial coloring of coffee beans, G. MORPURGO (*Ztschr. Nahr. Untersuch. u. Hyg., 12 (1898), No. 4, pp. 69, 70*).

Abnormal iodin number for lard, A. FERNAU (*Ztschr. Nahr. Untersuch. u. Hyg., 12 (1898), No. 4, p. 69*).

Apparatus for detecting sesame oil in butter and margarin when artificial coloring matter is present, C. A. NEUFELD (*Ztschr. Untersuch. Nahr. u. Genussmtl., 1898, No. 3, pp. 156–158, fig. 1*).

The estimation of starch in sausage, H. WELLER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 1898, No. 3, pp. 167–171*).

The detection and determination of saccharose in wine, A. BORNTRÄGER (*Ztschr. Analyt. Chem., 36 (1897), No. 12, pp. 767–776*).

Report of the city chemist of Christiania, Norway, for the year 1896, L. SCHMELCK (*Christiania, 1897, pp. 16*).

Division of chemistry, A. M. PETER (*Kentucky Sta. Rpt. 1896, pp. XI–XXIII*).—Analyses of 19 samples of butter made on the station farm; sugar and food constituents in 21 samples of sorghum and 18 of sugar beets; food constituents in 1 sample each of horseweed (*Ambrosia trifida*) and germ feed; and the fertilizing constituents in 5 samples of tobacco grown on the station grounds with different fertilizers, 7 samples of tobacco stalks, and 1 sample each of tobacco extract refuse, nitrate of potash, double potassium and magnesium carbonate, and wheat bran are reported, with the results of the examination of 6 samples of mineral waters and 1 of calcareous sandstone.

The examination of agricultural and commercial products, J. KÖNIG (*Die Untersuchung landwirtschaftlich und gewerblich wichtiger Stoffe. Berlin: Paul Parey, 1898, 2. ed., pp. 824, pl. 1, figs. 248*).—A revised edition of this practical laboratory manual. It contains chapters on the analysis of soil (including stone, lime, and cement); fertilizers; feeding stuffs; milk and dairy products; fats and oils; raw materials used in the manufacture of sugars, spirits, and vinegar; beer and brewing materials; wine; water, and wool. Chapters are also included on the testing of seeds, the preparation of laboratory reagents, and the injuries to vegetation due to the smoke, vapors, and dust from manufactories. Numerous tables are included.

BOTANY.

Report of the botanist, H. GARMAN (*Kentucky Sta. Rpt. 1896, pp. XXVIII–XXXIV, pls. 2*).—A considerable portion of the botanist's attention has been devoted to a study of the woolly mullein (*Verbascum phlomoides*), and attempts have been made to secure its eradication. It seems to be confined to very few counties of the State. It is believed that the methods adopted were successful in greatly reducing the number of the weeds. Concerning the ease with which the weed may be destroyed and the slowness with which it seems to be disseminated, the author believes that another season's work would practically eradicate it. In appearance the woolly mullein somewhat resembles the common mullein of the fields.

Some attention was also given during the season to the subject of broom rape of hemp and tobacco, and it was found that in addition to being parasitic on the roots of these plants it also attacks cabbage, rape, and shepherd's purse. All attempts to cause it to establish itself on watermelon, clover, wheat, and potatoes have failed.

Brief notes are given on the grass plats planted at the station to test the quality, yield, hardiness, rate of growth, etc., of different species of cultivated and native forage plants.

Mention is also made of cooperative experiments with the Division of Forestry of this Department in which the rate of growth, quality, etc., of trees of the same species grown from seeds collected in different parts of the United States are to be tested.

Investigations on the ripening of fleshy fruits, C. GERBER (*Ann. Sci. Nat. Bot., 8. ser., 4 (1897), No. 1–6, pp. 1–280, pls. 2*).—The author has made a study of the changes taking place in fleshy fruits during their ripening. The principal subjects of the extensive experiments were apples, grapes, and oranges, representing the malic, tartaric, and citric acid groups; the Japanese persimmon, representing the tannin-containing fruits; and the banana as a type containing an abundance of starch. In addition to these, comparisons were made with alkekengi, mangoes, apricots, peaches, pears, plums, melons, etc. Culture experiments with molds were maintained to verify the conclusions relative to transformations by the fruits. Whatever substances were noted in the fruit the same were added to the culture media in which *Sterigmatocystis nigra* was grown, and parallel experiments were conducted often with identically the same results. The gaseous exchange between the fruits and air was noted at different temperatures ranging from 0° to 30° C., such temperatures occurring either during the day or the night at the time of the normal maturity of the fruit. As far as possible the experiments were conducted with whole and sections of the fruits at different degrees of ripeness on and off the tree and during the mellowing of the fruit. After noting the respiration the fruits were subjected to chemical analysis to determine the presence of acids, tannin, starch, sugar, etc.

Contrary to the respiration of ordinary plants, fleshy sweet fruits, during a considerable portion of their development, give off a greater volume of carbon dioxid than the amount of oxygen taken up. The author considers the respiratory quotient under two heads—the acid quotient due to the presence of acids, and the fermentation quotient, by which is meant the respiration resulting in the production of alcohol, through an insufficient quantity of oxygen brought to the cells. These two respiratory quotients differ in respect to time and temperature at which each is most active, their value and intensity, and, by their chemical results, the fermentation quotient indicating the formation of alcohol and essential oils, while nothing comparable is indicated by the acid quotient.

The principal modifications found during the maturing of the fruits are shown in the chemical changes observed in the acids, tannins, starch, and sugar. The acids are partially transformed into carbohydrates. This is shown by the culture experiments with the mold and also from the fact that the amount of sugar found in the ripe fruit equals the starch and acids lost. The tannins are completely destroyed by oxidation, there being no evidence to show that it adds to the carbohydrate content of the well ripened fruit. The starch is transformed into sugar, as may be seen by comparing the relative amounts of the two carbohydrates from time to time during maturation. The sugars depend, as has already been shown, upon the starch and acids and in those fruits in which the fermentation quotient continues after maturity part of the sugar is transformed into alcohol, volatile acids, and perfumes.

The following practical deductions are drawn from the experiments: As acids and tannins disappear rapidly at high temperatures it is possible to hasten the ripening of apples, grapes, oranges, Japanese persimmons, sorbus, medlars, pears, etc., by exposing them to higher temperatures. The maturity of some apples, grapes, cherries, oranges, etc., may be retarded by cold storage at a temperature of about 0° C. The fruits of the sorbus, medlar, Japanese persimmon, etc., since they continue the fermentation quotient after maturity, can not be preserved for any considerable length of time either at a high or low temperature. The necessity for a high temperature for the transformation of the citric and tartaric acids and the oxidation of malic acid at a low temperature explain how apples, sorbus, medlars, and fruits containing malic acids mature best in cool climates, while grapes and oranges require higher temperatures. They also explain why the fruits of the apple, etc., readily ripen off the tree, while grapes and citrus fruits in general ripen best on the parent plant. The latter fruits may be ripened successfully off the plant if the temperature be sufficiently increased.

Respiration of plants at low temperatures, E. ZIEGENBEIN (*Naturw. Wchnschr., 1896, No. 9; abs. in Ann. Agron., 23 (1897), No. 7, pp. 333, 334*).—It is stated that Krussler in 1888 showed that cuttings of Rubus, leaves of *Phaseolus vulgaris*, *Ricinus communis*, and *Prunus lauro-cerasus* continued to respire at 0° C. The author shows that carbon dioxid is liberated by the germination of *Lupinus luteus* and *Triticum vulgare* at low temperatures. In the case of the lupine 100 gm. of germinating seed gave off 5.78 mg. carbon dioxid per hour at −2° C., and 100 gm. of sprouting wheat at 0° liberated 7.96 mg. carbon dioxid per hour.

The action of alcohol on the germination of fungus spores, P. LESAGE (*Ann. Sci. Nat. Bot., 8. ser., 3 (1896), pp. 151–159, fig. 1*).—Experiments with *Penicillium glaucum* and *Sterigmatocystis nigra*, in which cultures of the spores were suspended in a special form of apparatus, show that alcohol vapors up to concentrations of from 6 to 8 per cent acting alone do not prevent the germination of the spores. In the presence of watery vapor the limit is raised to about 15 per cent. Beyond these limits alcoholic solutions retard germination, and, if continued for a considerable time, kill the spores. The toxic action is exerted in a very short time when the alcohol acts alone, or more slowly in the presence of vapor of pure water. Increasing the strength of the solution or raising the temperature rapidly increases the toxic action.

On collecting and preparing fleshy fungi for the herbarium, E. A. BURT (*Bot. Gaz., 25 (1898), No. 3, pp. 172–186, pl. 1*).

On the fixing and preparation of salt water algæ, F. PFEIFFER and R. VON WELLHEIM (*Oesterr. Bot. Ztschr., 48 (1898), No. 2, pp. 53–58*).

Notes on introduced plants of Iowa, L. H. PAMMEL (*Proc. Iowa Acad. Sci., 4 (1897), pp. 110–118*).

Some molds in medicinal solutions (*Amer. Mo. Micros. Jour., 19 (1898), No. 1, pp. 1, 2, fig. 1*).—Brief notes are given on *Sterigmatocystis ochraceus* and *Aspergillus repens*.

Odontelytrum, a new genus of grasses of the tribe Panaceæ, E. HACKEL (*Oesterr. Bot. Ztschr., 48 (1898), No. 3, pp. 86–89*).—*Odontelytrum abyssinicum* is described.

Studies on fungi, C. TANRET (*Bul. Soc. Chim. Paris, 3. ser., 17 (1897), No. 20–21, pp. 921–927*).

The value of seed anatomy in the classification of the Parietales, E. PRITZEL (*Bot. Jahrb. [Engler], 24 (1897), pp. 348–394; abs. in Bot. Centbl., 73 (1898), No. 8, pp. 269–271*).

Anomalous flowers, H. VÖCHTING (*Jahrb. Wiss. Bot. [Pringsheim], 31 (1898), No. 3, pp. 391–510, pls. 6, fig. 1*).—Morphological and experimental investigations.

The province and problems of plant physiology, D. T. MACDOUGAL (*Science, n. ser., 7 (1897), No. 168, pp. 369–374*).

Anatomical studies of the leaves of some species of Andropogon, C. B. WEAVER (*Proc. Iowa Acad. Sci., 4 (1897), pp. 132–137, pls. 4*).—Studies were made of the leaves of *Andropogon provincialis, A. nutans, A. scoparius, A. sorghum,* and *A. sorghum halepensis.*

An anatomical study of the leaves of Eragrostis, C. R. BALL (*Proc. Iowa Acad. Sci., 4 (1897), pp. 138–146, pls. 3*).—The following species were studied: *Eragrostis reptans, E. pectinacea, E. purshii, E. frankii, E. mexicana,* and *E. major.*

A comparative study of the leaves of Lolium, Festuca, and Bromus, EMMA PAMMEL (*Proc. Iowa Acad. Sci., 4 (1897), pp. 126–131, pls. 3*).—Notes are given on the structural characters of *Lolium perenne, Festuca elatior pratensis, F. tenella,* and *Bromus patulus.*

A study of the leaf anatomy of some species of Bromus, EMMA SIRRINE (*Proc. Iowa Acad. Sci., 4 (1897), pp. 119–125, pls. 4*).—Studies were made of *Bromus patulus, B. inermis, B. secalinus,* and *B. breviaristatus.*

The theory of protoplasm and cell structure, A. KOBELT (*Naturw. Wchnschr., 13 (1898), Nos. 2, pp. 18–23; 3, pp. 28–32; 4, pp. 37–41, ill.*).

The mucilage cells of the Malvaceæ, A. NESTLER (*Oesterr. Bot. Ztschr., 48 (1898), No. 3, pp. 94–99, pl. 1*).

Concerning nictrotropic movements, L. JOST (*Jahrb. Wiss. Bot. [Pringsheim], 31 (1898), No. 3, pp. 345–390*).

Centrosomes in plants, L. GUIGNARD (*Bot. Gaz., 25 (1898), No. 3, pp. 158–164*).—The author thinks the existence of multipolar spindles not necessarily an argument against the existence of dynamic centers during cell division. Centrosomes may not always be definite morphological units. It is affirmed that the higher plants possess differentiated elements whose rôle is the same as that of those analogous bodies observed in the lower plants and in animals.

Investigations on the influence of manuring on the growth and plant food assimilation of barley, A. R. WELLMANN (*Inaug. Diss., Kiel, 1897, pp. 95, charts 8*).—An account of thesis work for the doctor's degree at the University of Göttingen.

Concerning the mineral content of normal and stunted kohl-rabi plants, J. ZAWODNY (*Ztschr. Naturw.* [*Jena*], *70* (*1898*), *No. 3, pp. 184–188*).

Concerning the substitution of arsenic acid for phosphoric acid in the nutrition of plants, J. STOKLASA (*Ann. Agron., 23* (*1897*), *No. 10, pp. 471–477*).—From experiments with oats the author concludes that while arsenic acid can not replace phosphoric acid in the living cell, it is able to induce the formation of furfurol derivatives, and consequently to increase the development of the organs of assimilation in the plant.

Concerning the growth of root hairs and rhizoids, A. SOKOLOWA (*Bul. Soc. Imp. Nat. Moscow, 1897, No. 2, pp. 167–277, pls. 3*).

Concerning the roots of Sorghum saccharatum, J. ZAWODNY (*Ztschr. Naturw.* [*Jena*], *70* (*1898*), *No. 3, pp. 169–183*).

The regeneration of injured roots, G. LOPRIORE (*Abhandl. K. Leopold. Carolin. Deut. Akad. Naturf., 66* (*1896*), *No. 3, pls. 8; abs. in Bot. Centbl., 73* (*1898*), *No. 8, pp. 276, 277*).—Treats of the repair of tissues that have been injured by splitting the roots of a number of plants.

Transition tissue, its origin and function in gymnospermous plants, W. C. WORSDELL (*Trans. Linn. Soc. Bot.* [*London*], *2. ser., 5, No. 8, pp. 301–309, pls. 4*).

The formation of cane sugar from dextrose in the vegetable cell, J. GRUSS (*Ber. Deut. Bot. Gesell., 16* (*1898*), *No. 1, pp. 17–20*).—A preliminary paper in which the author claims that cane sugar can be formed from dextrose in the cell, and that cellulose and starch are formed from cane sugar. In the formation of starch and cellulose no aldehyde groups were set free.

On the present status of the Nitragin question, J. STOKLASA (*Ztschr. Landw. Versuchw. Oesterr., 1* (*1898*), *No. 1, pp. 78–88*).

Concerning the conformity of the propagation of plants and animals, V. HÄCKER (*Biol. Centbl., 17* (*1897*), *Nos. 19, 20; abs. in Bot. Centbl., Beihefte, 7* (*1897*), *No. 5, pp. 340–343*).

The toxic action of phenols on living plants, R. H. TRUE and C. G. HUNKEL (*Proc. Amer. Pharm. Assoc., 45* (*1897*), *pp. 252–260*).

On the poisonous action of copper on various plants, M. MIYAJIMA (*Bot. Mag.* [*Tokyo*], *9* (*1897*), *No. 130, pp. 417–427*).

The accommodation of plants to hot and cold climates, J. COSTANTIN (*Bul. Sci. France et Belg., 31* (*1897*), *pp. 489–511*).

Lessons with plants, L. H. BAILEY (*New York: The Macmillan Co., 1898, pp. 491, figs. 446*).—This consists of popular suggestions for seeing and interpreting some of the common forms of vegetation. It is a valuable contribution to the nature studies for primary and secondary schools.

FERMENTATION—BACTERIOLOGY.

The occurrence of alcoholic ferments in nature and their transportation, A. BERLESE (*Riv. Patol. Veg., 5, pp. 211, 295, 354; abs. in Centbl. Bakt. u. Par., 2. Abt., 3* (*1897*), *No. 21–22, pp. 592–597*).—The author reports the results of investigations of soil from vineyards and from neighboring woods; bark from grapevines and from trees; leaves, flowers, fruit, etc., of the grape and other plants; insects, small animals, and the air, for the presence of the ferments so necessary to wine making. The organisms of alcoholic fermention were quite commonly found, although their occurrence was noticed at different times for different hosts. In April and June, *Saccharomyces apiculatus*, *S. ellipsoideus*, *S. pasteurianus*, forms of Torulopsis, *Mucor dematium*. etc., were found in the vineyard and wood soil, occurring at depths of 10 to 15 cm. in the vineyard and 4 to 36 cm. in the woods. Investigations showed their presence on the bark of oak and olive trees and elsewhere. None were found on the young grapes nor their peduncles in June, nor were any observed in the air during April or May, but in June and July *S. apiculatus* was found in the air.

Various insects were found to play a very important part in the distribution of the organisms. In general it is claimed that the alcoholic ferments are carried to the grapes by ants, flies, and gnats; they can pass uninjured through the digestive canal of the Diptera. They are very active in the intestines of the Diptera, the temperature being suited to their development.

Concerning cellulose fermentation, V. OMELIANSKI (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 25, pp. 1131–1133*).—In a previous paper (E. S. R., 9, p. 922) the author gave the principal characteristics of the ferments of pure cellulose. In the present one the products of the decomposition of cellulose by fermentation are given.

Cellulose enzyms, F. C. NEWCOMBE (*Bot. Centbl., 73 (1898), No. 4, pp. 105–108*).—The author presents a preliminary paper on studies on cellulose enzyms. In addition to those obtained from Peziza and barley by DeBary, Marshall Ward, and Morris and Brown, the author reports the isolation of enzyms from *Lupinus albus*, *Phœnix dactylifera*, and *Aspergillus oryzæ* that are capable of breaking down cellulose.

A study of the ferment which coagulates blood (fibrin ferment or thrombose), and the power of propeptones to prevent coagulation, A. DASTRE and N. FLORESCO (*Arch. Physiol. Norm. et Path., 5. ser., 9 (1897), pp. 216–228*).

Remarks on fibrin ferment and the alkalinity of peptic plasma, J. ATHANASIU and J. CARVALLO (*Arch. Physiol. Norm. et Path., 5. ser., 9 (1897), pp. 375–384*).

On the action of diastase, E. DUCLAUX (*Ann. Inst. Pasteur, 11 (1897), No. 10, pp. 792–800*).—A critical review of the subject.

The general laws of the action of diastases, E. DUCLAUX (*Ann. Inst. Pasteur, 12 (1898), No. 2, pp. 96–127*).

A critical review of the action of diastases, E. DUCLAUX (*Gaz. Brasseur, 1897, No. 533*).

The chemical nature of diastase, T. B. OSBORNE (*Ber. Deut. Chem. Gesell., 31 (1898), No. 3, pp. 254–259*).—See also Connecticut State Sta. Rpt. 1895, p. 233 (E. S. R., 8, p. 368).

Studies on ammoniacal fermentation and on the ferments of urea, P. MIQUEL (*Ann. Microg., 1897, No. 7–8, pp. 302–325*).

Investigations on the nitric organism described by Stutzer and Hartleb, C. FRAENKEL (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), Nos. 1, pp. 8–13; 2, pp. 62–67*).—Culture experiments with 11 organisms derived from the same source as that of the organism described by Stutzer and Hartleb are reported. The results indicate that the nature of the Stutzer and Hartleb organism is not definitely fixed by their vague description of it.

Investigations on the nitric organism of Stutzer and Hartleb, A. GÄRTNER (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), Nos. 1, pp. 1–7; 2, pp. 52–61; 3–4, pp. 109–119, pls. 2*).—Experiments with 13 cultures obtained from Stutzer are reported in detail.

The effect of the mineral and nitrogen content in the culture medium on the characteristics and activity of yeasts, R. KUSSEROW (*Brennerei Ztg., 14 (1897), No. 318; abs. in Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 3–4, pp. 154–156*).

Bacteriological studies, L. F. ROSENGREN (*K. Landt. Akad. Handl. Tidskr., 36 (1897), No. 5, pp. 287–298*).—Observations of bacteriological technique at European institutions of education and research.

Bacteriological technique, A. BESSON (*Technique microbiologique et seropathique. Paris: J. B. Baillière et fils, 1898, pp. XI, 581, figs. 223*).—A laboratory guide.

Concerning the production of sulphureted hydrogen, indol, and merkaptan by bacteria, M. MORRIS (*Arch. Hyg., 1897, p. 304; abs. in Bot. Centbl., 73 (1898), No. 7, pp. 216, 217*).

A violet bacillus from the Thames, H. MARSHALL WARD (*Ann. Bot, 12 (1898), No. 45, pp. 59–74, pl. 1*).—Describes a violet pigment forming bacillus.

A new chromogenic Micrococcus, A. CANTANI (*Centbl. Bakt. u. Par., 1. Abt., 23 (1898), No. 8, pp. 308–311*).

Studies of the acetic acid forming bacteria, W. HENNEBERG (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), Nos. 1, pp. 14–20; 2, pp. 67–73; 3–4, pp. 138–147, figs. 2*).

The effect of the addition of sugar in checking the bacterial liquefaction of gelatin, W. AUERBACH (*Arch. Hyg., 31 (1897), No. 4, pp. 311–318*).

Concerning the structure of micro-organisms, V. RŮŽIČKA (*Centbl. Bakt. u. Par., 1. Abt., 23 (1898), No. 8, pp. 305–307, pl. 1*).

ZOOLOGY.

Indian wild cattle: The tsine and the gaur (miscalled bison), POLLOK (*Zoologist, 4. ser., 2 (1898), No. 13, pp. 1–10*).—The tsine (*Bos sondaicus*) and the gaur (*B. gaurus*) are discussed by a hunter. Two distinct forms of the latter species are found, known as the gaur and the gayal. At a distance both look alike, but the gaur's head has a semicylindrical crest and a concave forehead. The head of the gayal has neither. In the gaur again there are two varieties, distinguished by the natives as jungle cow and jungle buffalo. One has a large dewlap, the other scarcely any, or none. When captured the animals, after passing through a period of great pugnacity, become very tame.

Preliminary description of a new mountain sheep from the British Northwest Territory, J. A. ALLEN (*Bul. Amer. Mus. Nat. Hist., 9 (1897), pp. 111–114, pls. 2*).—The species *Ovis stonei* differs from *O. dalli* in being dark gray or blackish brown. This coloration also distinguishes it from *O. cervina*, which is umber brown or wood brown. It is also a smaller animal than the latter. Three specimens were obtained from the head waters of the Stickeen River, in British Northwest Territory, near the Alaskan boundary.

Description of a new deer (Dorcelaphus texanus) from Texas and northern Mexico, E. A. MEARNS (*Proc. Biol. Soc. Washington, 12 (1898), pp. 23–26*).

Descriptions of six new ground squirrels from the Western United States, C. H. MERRIAM (*Proc. Biol. Soc. Washington, 12 (1898), pp. 69–71*).—*Spermophilus oregonus* from Swan Lake Valley, Oregon; *S. mollis stephensi* from Owens Valley, Nevada; *S. mollis yakimensis* from Yakima County, Washington; *S. mollis canus* from Wasco, Oregon; *S. tridecemlineatus alleni* and *S. tridecemlineatus texensis* from Cook County, Texas.

Descriptions of two new skunks of the genus Mephitis, O. BANGS (*Proc. Biol. Soc. Washington, 12 (1898), pp. 31–33*).—*Mephitis spissigrada* from Sumas, British Columbia, and *M. avia* from San Jose, Illinois. In general appearance the former much resembles *M. hudsonica* and *M. occidentalis*, into which two species it intergrades. The other species is small, with a very short and bushy tail and a peculiar skull. It is black everywhere except a white frontal stripe and nuchal patch and two lateral or subdorsal white stripes passing backward from the nuchal patch.

Descriptions of the Newfoundland otter and red fox, O. BANGS (*Proc. Biol. Soc. Washington, 12 (1898), pp. 35–38*).—*Lutra degener*, n. sp., and *Vulpes deletrix*, n. sp.

The eastern races of the American varying hare, with description of a new subspecies from Nova Scotia, O. BANGS (*Proc. Biol. Soc. Washington, 12 (1898), pp. 77–82*).—*Lepus americanus struthopus*, n. subsp.

Description of a new rodent of the genus Idiurus, G. S. MILLER (*Proc. Biol. Soc. Washington, 12 (1898), pp. 73–76, figs. 5*).—*Idiurus nacrotis* from the Cameroon district, West Africa.

Description of a new white-footed mouse from the Mount Baker Range, British Columbia, O. BANGS (*Proc. Biol. Soc. Washington, 12 (1898), pp. 83, 84*).—*Peromyscus oreas*, n. sp.

A new species of Evotomys from British Columbia, V. BAILEY (*Proc. Biol. Soc. Washington, 12 (1898), pp. 21, 22*).—A description of *Evotomys caurinus* found along the coast of British Columbia.

Hybrids between the gamecock and the guinea fowl, T. VILARÓ (*Bul. Amer. Mus. Nat. Hist., 9 (1897), pp. 225–230, pls. 3*).—Six cases are described. There was a lack of any procreative tendency in both males and females. The quarrelsome disposition of the guinea fowl was preserved. The hybrids would even combine in attacks upon other fowls.

Description of new birds from Mexico, with a revision of the genus Dactylortyx, E. W. NELSON (*Proc. Biol. Soc. Washington, 12 (1898), pp. 57–68, fig. 1*).

Twenty years' observations on the migrations of the birds of the Luxembourgeoise fauna, 1863 to 1894, A. DE LA FONTAINE (*Pub. Inst. Grand Ducal de Luxembourg, 25 (1897), pp. 238, pl. 1*).—The observations are given in detail and the subject of bird migration and its causes generally discussed. The orientation of the birds is attributed to a sixth sense. The work also contains a necrological notice of the author.

Extract from the laws of the Empire concerning the protection of birds (*Jahresber. Ver. Naturk. Zwickau, 1896, pp. 84–86*).—The laws of the German Empire relating to the subject.

The birds of the vicinity of Zwickau, R. BERGE (*Jahresber. Ver. Naturk. Zwickau, 1896, pp. 83, figs. 174*).—A systematic treatment of the subject.

The voice registers of birds, C. W. WITCHELL (*Zoologist, 4. ser., 2 (1898), No. 13, pp. 11–13*).

The tongues of birds, F. A. LUCAS (*Smithson. Rpt. 1895, pp. 1003–1020, pls. 2, figs. 13*).—An anatomical study of considerable interest in which specific and individual variations are noted and figured.

On a new Tænia of birds, O. FUHRMANN (*Rev. Suisse Zool., 5 (1897), pp. 107–117, pl. 1; abs. in Zool. Centbl., 5 (1897), No. 2, p. 46*).—*Citto tænia avicola*, n. sp., from *Anas* sp. In the genital organs, number of testes, and position of the excretory canals it is related to *C. marmotæ*, and in the structure of the cirrus to *C. pectinata*.

Notes on Trematode parasites of fishes, E. LINTON (*Reprint (No. 1133) from Proc. U. S. Nat. Mus., 20 (1897), pp. 507–548, pls. 15*).—The new species, *Nitzchia papillosa* from *Gadus callarias*, *Octoplectanum affine* from *Paralichthys dentatus*, *Distomum læve* from *Macrourus bairdii*, *D. monticellii* from *Remora remora*, *D. lageniforme* from *Remora remora*, *D. foliatum* from *Mola mola*, *D. nitens* from *Tylosurus caribbæus*, *D. tenue* from *Roccus lineatus*, and *D. tenue tenuissime* from *Marone americana*, are described. In all 32 species and subspecies are listed. The other genera represented are Tristomum, Diplostomum, and Monostomum.

The Myxosporidia in the musculature of the genus Coregonus, F. ZSCHOKKE (*Zool. Anz., 21 (1898), No. 554, pp. 213, 214*).—The author is of the opinion as a result of his studies that all of the Myxosporidia found in the musculature of Coregonus occurring in the waters of Switzerland belong to the same species. Since none of the 3 species recorded have been sufficiently described or figured the author proposes to group them all as *Myxobolus bicaudatus*, which he describes. This species is found often in large numbers in the connective tissue of the musculature of Coregonus.

The Arcturidæ in the U. S. National Museum, J. E. BENEDICT (*Proc. Biol. Soc. Washington, 12 (1898), pp. 41–51, figs. 9*).—A key to the species of the genus Arcturus and descriptions of several new species are given.

Work in zoology in 1896 (*Zoologist, 4. ser., 2 (1898), No. 13, p. 39*).—According to the enumeration of the Zoological Record, in 1896 there appeared 291 papers dealing with mammals, 639 with birds, 307 with reptiles and batrachia, 240 with fishes, 30 with tunicates, 391 with mollusks, 20 with brachiopods, 21 with bryozoa, 206 with crustacea, 114 with arachnids, 56 with myriapods and prototracheates. 1,264 with insects, 251 with vermes, 122 with cœlenterates, 57 with sponges, and 190 with protozoa. According to Dr. Sharp no less than 8,907 distinct species and 1,040 genera and subgenera were described as new.

METEOROLOGY.

Special meteorological features of the year 1895, F. HOUDAILLE (*Ann. École Nat. Agr. Montpellier, 9 (1895–'96), pp. 17–25, charts 24*).—The special meteorological features (temperature, pressure, precipitation, humidity, evaporation, cloudiness, wind movement, etc.) of each month of the period from December, 1894, to November, 1896, inclusive, are charted and discussed and their influence on the growth of the vine during the season of 1895 briefly noted. The most marked features of the season were a prolonged period of rainfall during the summer and a maximum temperature in September, instead of July or August as usual. As a result of these conditions there was an unprecedented invasion of mildew, due to the high temperature and great humidity, but a very superior quality of grapes, due to the prolonged high temperature during the period of ripening.

The daily measurement of dew in 1895, F. HOUDAILLE (*Ann. École Nat. Agr. Montpellier, 9 (1895–'96), pp. 26–32*).—Measurements during the period from December, 1894, to November, 1895, inclusive, of the dew deposited upon a glass plate with an area of 25 sq. cm., are tabulated and discussed and compared with similar observations in previous years. A summary of the monthly dew measurements during 1893, 1894, and 1895 is given in the following table:

Depth of dew during each month of 1893–'95.

	1893.	1894.	1895.	Average, 1893–'95.
	Mm.	*Mm.*	*Mm.*	*Mm.*
January	0.448	0.559	0.038	0.348
February	.072	1.114	.104	.430
March	.834	.854	.436	.708
April	.696	.608	.536	.613
May	.284	.247	1.168	.564
June	.648	.874	.398	.640
July	.140	.464	.562	.389
August	.968	.952	.675	.865
September	.676	.660	1.078	.805
October	1.602	1.096	.580	1.093
November	.310	.912	.557	.593
December	1.026	1.466	.368	.953

Causes of the maximum rates of evaporation in the climate of Montpellier, F. HOUDAILLE (*Ann. École Nat. Agr. Montpellier, 9 (1895–'96), pp. 286–295, figs. 2*).—Observations during each month of 1896 on velocity of evaporation, temperature, hygrometric condition of the air, and velocity of the wind are recorded, as well as the monthly averages of evaporation for ten years (1875–'84). These observations were made by Piche and self-recording evaporometers over a surface of water in a metallic dish 10 sq. cm. in area. A summary of the results is given in the following table:

Mean maximum temperature, humidity of air, and velocity of wind.

	Mean maximum temperature, 1896.	Humidity at 9 a. m., 1875–'88.	Velocity of wind, 1883–'96.
	Deg. C.	*Per cent.*	*M. per sec.*
January	11.47	81.77	4.24
February	14.97	76.39	4.76
March	18.88	.70	4.95
April	21.59	.67	4.87
May	26.01	.62	4.51
June	28.63	.58	4.49
July	33.25	.56	4.41
August	30.07	.57	3.83
September	27.01	.66	3.76

Variations in winds in the climate of Montpellier, F. Houdaille (*Ann. École Nat. Agr. Montpellier, 9 (1895–'96), pp. 164–175, figs. 2*).—This is a discussion, with tabulated record of observations from 1883 to 1896, on variations in the velocity and force of winds. The following formula is used for expressing the force of winds: $P=KV^2$, V representing the velocity and K a coefficient varying with the form and size of the surface exposed to the wind. For a surface of 1 square meter K is assumed to be 0.125. The average annual velocity of wind observed at Montpellier is 4.36 meters per second. The force per square meter is, therefore, 2.376 kg. From this it is calculated that the amount of force per square meter available for windmills is $2.376 \times 4.36 = 10.36$ kg., one-half of which may be utilized.

Actinometric observations during the year 1895, A. Crova (*Ann École Nat. Agr. Montpellier, 9 (1895–'96), pp. 145–149, charts 2*).—The number of hours of sunshine at the meteorological observatory at Montpellier during the year 1895 were as follows: Winter, 526 hours 31 minutes; spring, 585 hours 16 minutes; summer, 739 hours 2 minutes; autumn, 434 hours 44 minutes; total, 2,285 hours 33 minutes. The intensity of sunlight [1] was least in winter, but increased gradually until the month of March, when it reached 1.2 small calories (gram-degrees). It afterwards decreased, but rose again, reaching its first maximum, 1.22 calories, in June. The second maximum, 1.3 calories, was reached in September, after which the intensity diminished until the 1st of December.

Division of meteorology, V. E. Muncy (*Kentucky Sta. Rpt. 1896, pp. XXXVIII–XLIII*).—Monthly summaries of observations during 1896 on temperature, atmospheric pressure, precipitation, sunshine and

[1] The intensity is the quantity (in small calories) of heat received in 1 minute by a black surface 1 square centimeter in extent exposed directly to sunlight.

cloudiness, wind movement, and casual phenomena are reported in tables. The principal data for the year are as follows:

Temperature (degrees F.).—Maximum, 95, September 18; minimum, —2, February 21; mean, 55.9; absolute range, 52; mean daily range, 17.2. *Atmospheric pressure* (inches).—Highest, 29.58, December 24; lowest, 28.21, February 21; mean, 29.03. *Precipitation* (inches), 43.29; number of days on which 1 in. or more of rain fell, 13. Clear days, 63; cloudy or partly cloudy days, 303. *Wind.*—Prevailing direction SW.

Measurement of the coefficient of viscosity of the air, C. FABRY and A. PEROT (*Ann. Chim. et Phys., 7. ser., 13 (1898), Feb., pp. 275–288, figs. 2*).

The measurement of the coefficient of diffusion of aqueous vapor in the atmosphere and of the friction coefficient of aqueous vapor, F. HOUDAILLE (*Ann. École Nat. Agr. Montpellier, 9 (1895–'96), pp. 35–126, figs. 9, charts 3*).—This is a technical paper describing in detail the methods and results of determinations of these coefficients. The coefficient of diffusion of aqueous vapor at 0° found by direct measurement was $D_0=0.203$; the coefficient of friction of air $\eta_0=0.000186$, of aqueous vapor $\eta'_0=0.0000975$.

Description of a maximum anemometer, F. HOUDAILLE (*Ann. École Nat. Agr. Montpellier, 9, (1895–'96), pp. 5–16, figs. 3*).—The instrument is described and tests of it are reported.

Meteorological observations on the Atlantic Ocean, PRINCE OF MONACO (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 5, pp. 373–375*).

Meteorological observations, 1896–'97, W. B. ALWOOD (*Virginia Sta. Rpt. 1897, pp. 7, 8*).—Tables give monthly summaries of observations on temperature, precipitation, direction of wind, and cloudiness for the period from July 1, 1896, to June 30, 1897; and, for comparative purposes, monthly summaries of observations on temperature and precipitation for five years (1893–'97). The mean temperature for the period from July 1, 1896, to June 30, 1897, was 51.56° F., the total rainfall 42.32 in. The mean temperature for the five-year period was 51.7° F., the mean rainfall 36.18 in.

Meteorological and agricultural notes, J. B. CHABANEIX (*Ann. École Nat. Agr. Montpellier, 9 (1895–'96), pp. 127–140*).—This is a record of observations during the period from December, 1894, to December, 1895, on temperature of the air (maximum, minimum, and average), and of the soil (at the surface and at a depth of 0.25 meter), rainfall, evaporation, humidity, direction of wind, cloudiness, frosts, and thunderstorms, with general notes on the character of the season and its influence upon the growth of crops.

On the character of seasons and of successive years, P. GARRIGOU-LAGRANGE (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 11, pp. 829–831*).

Climatology as distinguished from meteorology, M. WHITNEY (*Science, n. ser., 7 (1898), No. 161, pp. 113–115*).—Climatology is defined as "the relation between the meteorological elements as measured by the development of the plant." The general relation of the principal elements may be expressed by the equation

$$\text{Sunshine}\left(\frac{\text{Temperature} \times \text{wind velocity}}{\text{Humidity} \times \text{soil moisture.}}\right) = \text{constant condition of plant growth,}$$

or in still more general terms

$$(1)\quad \psi(s)\,\frac{\phi(t)\quad \theta(v)}{\Gamma(h)\quad \triangle(w)} = k, \text{ conditions favorable for the vegetative period.}$$

$$(2)\quad \psi'(s)\,\frac{\phi'(t)\quad \theta'(v)}{\Gamma'(h)\quad \triangle'(w)} = k', \text{ conditions favorable for the ripening or fruiting period.}$$

In these equations s = intensity of sunshine, t = temperature, v = velocity of the wind, h = relative humidity, and w = soil moisture.

Three of the elements being constant, it should be possible to determine the approximate variations in the other best suited to different classes of plants for different periods of growth.

The periods of plant growth and the effects of climatic conditions on plants, J. B. CHABANEIX and P. DUCHEIN (*Ann. École Nat. Agr. Montpellier, 9 (1895–'96), pp. 142–144, 296, 297*).—This is a tabulated record of observations on the date of germination, leafing, flowering, maturity, and defoliation during 1894–'95 of 22 deciduous and 8 evergreen trees and shrubs, 5 perennial herbaceous plants, and 17 annual plants, and a similar series of observations during 1895–'96 on 22 deciduous and 8 evergreen trees and shrubs.

WATER—SOILS.

Tobacco soils of the United States, M. WHITNEY (*U. S. Dept. Agr., Division of Soils Bul. 11, pp. 47, pls. 13*).—This bulletin gives a brief review of recent literature on tobacco, statistics of tobacco production in different tobacco-growing districts of the United States, meteorological conditions in the great tobacco regions, and texture and water content of typical soils of the various tobacco-growing districts.

The conclusion is drawn that there is not sufficient difference in the meteorological conditions in the different regions, as ordinarily recorded, "to explain the distribution of the different classes of tobacco, yet this distribution is probably due mainly to climatic conditions. . . .

"One must still judge, so far as the climate is concerned, mainly from the experience of others as to the class of tobacco to be raised, as the ordinary meteorological record will be of very little value in determining this point. The plant is far more sensitive to these meteorological conditions than are our instruments. Even in such a famous tobacco region as Cuba tobacco of good quality can not be grown in the immediate vicinity of the ocean or in certain parts of the island, even on what would otherwise be considered good tobacco lands. This has been the experience also in Sumatra and in our own country, but the influences are too subtle to be detected by our meteorological instruments.

"Little, therefore, can be said at the present time in regard to the suitable climatic condition for tobacco of any particular type or quality."

Next to climatic conditions the class and type of tobacco depends more largely upon the character of soil than upon any other condition. The present bulletin reports and discusses mechanical anaylses of a large number of samples of soil and subsoil collected in the more important tobacco districts, and also gives records of determinations of the moisture content during several years "in one or two localities in some of the principal tobacco districts."

The results show that the cigar tobacco soils of the Connecticut Valley contain on an average considerably less than 5 per cent of clay and maintain on an average about 7 per cent of water throughout the season. "These soils are too light in texture for any of the staple farm crops. They are adapted to the quick-growing spring vegetables. . . . The conditions seem to be peculiarly adapted to a particular grade of wrapper leaf tobacco." Attention is called to the fact that a few years ago, when there was a greater demand for heavier cigars, these light soils had little or no value for tobacco, the tobacco being grown mainly on the heavier soils and on the "meadow lands" of the Connecticut Valley. These meadow lands differ from the light tobacco soils now cultivated principally in containing a larger proportion of silt, which enabled them to maintain a water content of from 23 to 27 per cent.

The tobacco lands of Pennsylvania, which are also devoted mainly to growing cigar tobacco, are confined chiefly to a comparatively narrow belt along the Susquehanna River and to the limestone soils "typically developed in York and Lancaster counties." The amount of clay in these soils varies from 13.8 per cent in the river soils and shaly limestone soils to 29.27 per cent in the pure limestone soils. They maintain on an average about 18 per cent of water, the amount rising to 22 to 23 per cent in the heaviest limestone soils. The best wrapper leaf is produced on the lighter soils.

"The cigar tobacco district of Ohio is situated in the southwestern part of the State and includes the country bordering on the Miami River, Montgomery, Darke, and Preble counties forming the center of the district. . . . The soil is derived from drift material which has been worked over and modified by subsequent action of water." A typical soil from this region was found to contain 44.01 per cent of silt and 27.52 per cent of clay. It thus appears that the soils of this district are as heavy in texture as the limestone soils of Pennsylvania. During the season of 1897 they maintained a moisture content of a little more than 27 per cent. "It is probable that the mean water content of these soils in an average season would amount to about 23 or 24 per cent of water. The tobacco grown under these conditions is used almost exclusively as a filler leaf. . . .

"The Wisconsin tobacco is used both as a wrapper and filler leaf to some extent." It is grown on soils a typical sample of which was found to contain 36.05 per cent of silt and 22.76 per cent of clay. No determinations of the moisture content of these soils have been made.

The Cuban type of cigar wrapper and filler and some Sumatra tobacco are grown in Florida, especially in western Florida, although a new tobacco district is being opened up in the region of Fort Mead, on the peninsula. The tobacco lands of western Florida are "a light loam about 12 in. deep, resting on a heavy red clay, which is naturally well drained. The hammock soil of Fort Mead is, on the other hand, a very light, sandy soil, extending down to a very considerable depth." The red subsoils of western Florida contain about 30 per cent of clay, but maintain on an average only about 8 to 10 per cent of moisture. The hammock lands "contain on an average less than 4 per cent of clay and less than 6 per cent of silt, fine silt, and clay. They contain over 50 per cent of fine sand, so that they are relatively rather coarse and open. Notwithstanding this open texture . . . [they] contain on an average 8 per cent of water throughout the season, which is about as much as the tobacco lands of the Connecticut Valley contain. This water content, moreover, is for some reason more uniform, and the land can go for some time without rain with no serious injury to the crops. Nevertheless the planters have been greatly benefited by judicious systems of irrigation through overhead sprays. By thus keeping the plants continually and rapidly growing, the crop will mature in 45 days from the time the plants are set out."

The soils of the cigar tobacco districts which are being developed in Texas and southern California have not been thoroughly studied, but the analyses which have been made indicate that the soils "agree very well with the finer grades of cigar tobacco lands. The general climatic conditions, however, are different." . . .

"The bright yellow tobacco used for cigarettes, plug wrappers, fillers, and cutting is grown mainly in Virginia, North Carolina, South Carolina, and East Tennessee. . . . The typical bright tobacco land consists of a loose, porous sand, containing not more than 8 or 10 per cent of clay. This sand must be at least 12 in. deep. Many areas are cultivated in which the sand extends to a depth of 5 or 10 ft. or more, and a very fine quality of tobacco is produced."

The average of analyses of 44 samples of bright tobacco soils shows that they contain about 8 per cent of clay. They maintain on an average about 7 per cent of water.

"Where the soils contain less than this the leaf is inclined to be finer in texture and to have a better color, but the yield per acre is small, and the most economical conditions on the whole are maintained by those soils having from 7 to 8 per cent of clay and maintaining on an average about 7 or 8 per cent of water. As the soil becomes heavier in texture and the amount of water increases other grades and types of tobacco are produced. . . . As the relation of the physical properties of the soil is not thoroughly understood or practically recognized by the growers, a large amount of land is now cultivated in bright tobacco which is not suited to this plant and which does not produce a good grade. On the other hand, there are large areas not at present under cultivation which could be developed into very fine tobacco lands. The typical bright tobacco soil is of little value for any of the staple farm crops, although, when suitably located near transportation lines, it is admirably adapted to the production of early vegetables, watermelons, and sweet potatoes."

The manufacturing tobacco of Virginia and North Carolina is grown principally on the red clay soils located mainly on the gabbro, gneiss, and Lafayette clays. The subsoils of these areas contain from 30 to 50 per cent of clay, and although no observations have been made on the moisture content of these soils it is probable from observations made on adjacent soils that the mean water content is not far from 20 or 22 per cent. Since the introduction of White Burley tobacco the cultivation of the heavier types of tobacco has noticeably decreased in Virginia and North Carolina. "The industry is confined now principally to small areas along rivers, streams, or creeks, and upon recent deposits which can not well be referred to any of the older geological formations and which can not well be examined without a detailed examination of the larger part of these States. . . .

"The White Burley tobacco is confined to the well-marked type of soil of the Lower Silurian limestone in central and north central Kentucky and the adjacent counties of Ohio. This embraces the blue grass region of Kentucky, and it is upon these fine, fertile, blue grass soils that the White Burley is grown." The soils are all heavy clays of a uniform deep red color. The subsoils contain on an average about 30 per cent of clay. "The characteristic soil of the limestone area of Kentucky, adapted to the White Burley tobacco, as the result of several years' investigation, may be said to maintain on an average about 20 per cent of water."

Export tobacco is grown in Kentucky and Tennessee on silty soils, which are quite fertile in character. These soils are derived chiefly from the St. Louis group of the subcarboniferous. They contain from 40 to 60 per cent of silt and 22 to 23 per cent of clay, and maintain an average water content of about 15 per cent.

"The object of the daily record of moisture in the soil is not only to determine the average amount soils contain, but to determine the normal as well as the extreme variation. . . . It is possible from such records to show the character of a season. The methods of cultivation should have for their prime object the maintenance of the water supply above the line of drought, so that the growth of the plant shall receive no check. If this can not be done by the ordinary method of cultivation, irrigation must be resorted to upon such occasions, if the crop is to be maintained in its best condition."

The moisture of the soil in 1895 and 1896, F. HOUDAILLE (*Ann. École Nat. Agr. Montpellier, 9 (1895–'96), pp. 150–163, charts 2*).—This is a continuation of work of previous years,[1] and consists of monthly determinations of moisture in a calcareous clay soil with free drainage and a more compact soil, at the surface and at depths of 0.25, and 0.05, and 1 meter. The relation between the moisture in both soils, the rainfall, and evaporation is summarized in the following table:

Relation of moisture of the soil, rainfall, and evaporation, 1895–'96.

	Evaporation.		Precipitation (A).		Corrected evaporation (B).		A—B.		Moisture at depth of 0.25 meter.	
	1895.	1896.	1895.	1896.	1895.	1896.	1895.	1896.	1895.	1896.
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Per ct.*	*Per ct.*
January	104.5	71.0	5.0	11.3	39.9	27.2	— 34.9	—15.9	10.8	13.3
February	84.6	72.8	97.3	56.5	32.4	27.9	+ 64.9	+28.6	13.2	12.0
March	161.8	166.5	41.0	9.5	62.0	63.8	— 21.0	—54.3	12.6	11.0
April	134.4	211.2	54.0	7.5	51.5	81.0	+ 2.5	—73.5	12.4	9.0
May	120.6	215.5	203.0	13.5	46.2	82.5	+156.8	—69.0	12.7	5.2
June	129.6	168.3	95.0	49.3	49.6	64.8	+ 45.4	—15.5	9.2	4.9
July	199.6	263.2	12.0	17.5	76.2	101.0	— 64.2	—83.5	4.6	4.5
August	167.4	228.5	20.0	13.0	64.2	49.3	— 44.2	—36.3	3.8	4.5
September	141.3	163.5	4.5	39.0	54.1	62.8	— 49.6	—23.8	4.2	6.1
October	94.2	93.0	144.5	62.5	36.0	35.7	+108.5	+73.2	7.2	5.4
November	47.7	81.0	94.0	97.0	18.2	31.2	+ 75.8	+65.8	13.0	9.4
December	89.9	96.1	11.0	79.0	34.4	36.9	— 23.4	+42.1	11.2	14.4

On the improvement of humus soils, J. DUMONT (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 13, pp. 469–472*).—The effect of different fertilizers on the formation of ammoniacal and nitric nitrogen was

[1] Bul. Met. Hérault, 1886, 1890, 1892, 1894.

observed in a humus soil containing nitrogen, 1.32 per cent; phosphoric acid, trace; lime, 0.42 per cent; and potash, 0.036 per cent.

The results of the observations on the production of nitric nitrogen were as follows:

Nitric nitrogen produced in 1,000 grams of soil in 40 days.

	Mg.
Check	2.8
Potassium carbonate (0.1 per cent)	57.8
Peat ashes (0.5 per cent)	10.2
Unleached ashes (0.5 per cent)	19.0
Leached ashes (0.5 per cent)	3.3
Calcium carbonate (2 per cent)	5.3
Marly clay (2 per cent)	7.5
Burnt clay (2 per cent)	7.0
Potassium sulphate (0.1 per cent) and calcium carbonate (2 per cent)	32.5
Potassium chlorid (0.1 per cent) and calcium carbonate (2 per cent)	38.0
Potassium chlorid (0.1 per cent) and slag (5 per cent)	41.5

The results of the observations on the formation of ammoniacal nitrogen were as follows:

Ammoniacal nitrogen produced in 1,000 grams of soil in 24 days.

	Mg.
Check	4.0
Potassium carbonate (1 per cent)	15.0
Potassium carbonate (0.5 per cent)	40.0
Potassium carbonate (0.25 per cent)	62.0
Potassium carbonate (0.1 per cent)	82.0
Sodium carbonate (1 per cent)	
Sodium carbonate (0.5 per cent)	46.0
Calcium carbonate (1 per cent)	4.7
Potassium chlorid (0.5 per cent) and slag (1 per cent)	130.0
Potassium chlorid (0.25 per cent) and slag (0.5 per cent)	96.0

The best results were obtained with the mixture of muriate of potash and slag, which has also been successfully applied in practice. The alkaline carbonates in small amounts favored the production of both ammoniacal and nitric nitrogen, but the action of both the ammonia and nitric ferments was checked by the application of large amounts of these carbonates. Calcium carbonate exerted little influence except when used in connection with potassic fertilizers, the effect in this case probably being due to the potassium carbonate formed by double decomposition. The vigorous action of the potassium carbonate is attributed to the power of forming potassium humate, which readily undergoes nitrification. This formation of humates appears to be an indispensable condition in improving the fertility of humus soils, and is probably best secured by using a mixture of potash salts and calcium carbonate, which, as stated above, yields potassium carbonate in the soil. If the soil is already rich in potash, the desired result may be accomplished by simply adding lime, which gradually sets the soil potash free. If the soil is poor in potash the potassic fertilizer should be used in connection with a relatively small amount of lime, or of slag if phosphoric acid is also deficient.

On the question of the decomposition of nitrates by bacteria, S. A. SEWERIN (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), Nos. 19–20, pp. 504–517; 21–22, pp. 554–563, figs. 3*).—An account is given of culture experiments with 29 different organisms isolated from horse manure in previous investigations of the author on denitrification.[1] Of these 29 cultures 3 were strictly anærobic, 1 was a facultative anærobe, and 25 strictly ærobic. The culture medium used was meat peptone bouillon containing 0.3 per cent sodium nitrate. Cultures were made in Pasteur tubes containing 20 cc. of the bouillon which were kept at 30° C. temperature for ten days in a thermostat. At the end of that time the different cultures were tested for the presence of nitrates and nitrites. In 2 cases no reaction was obtained for either nitrites or nitrates, showing that denitrification was complete. In 9 cases no nitrates were found, but nitrites were abundant. In 18 cases the nitrates were apparently unaltered. In further experiments with the 9 cultures which formed nitrites it was found that when the proportion of nitrate in the culture medium was reduced to 0.1 per cent, 2 of the cultures destroyed all traces of both nitrates and nitrites in ten days; the remaining 7 transformed the nitrates into nitrites, but did not reduce the nitrites in that time. Of these 7 organisms 4 were microbacteria, 1 was a rod-shaped bacterium, 1 a coccus, and 1 *Bacillus indicus*. The different organisms are described in detail and experiments in different culture media under different conditions are reported, especial attention being given to a comparison of the reducing power for nitrates of the author's culture No. 3 and *Bacillus pyocyaneus*. The latter experiments showed that both organisms rapidly reduce nitrates, a part of the nitrogen apparently being used to form organic compounds. With moderate surface aeration a very small amount of the nitrogen was converted into ammonia. By far the greater part of the nitrate, however, was evidently reduced to free nitrogen or oxids of nitrogen. The reduction of nitrates was delayed in each case by the admission of air and by the formation of nitrites and alkali by the activity of the organism. It appears from these experiments that these organisms may be injurious in the soil in destroying nitrates. The precaution to be taken against their harmful activity is thorough aeration of the soil by proper cultivation.

The evaporation of water from water surfaces, from the soil, and by vegetation, E. CANESTRINI (*Atti Soc. Veneto-Trentina Sci. Nat., 2. ser., III, No. 2*).

Soil classification especially as applied to Russia, N. SSIBIRZEFF (*Ann. Géol. et Minéral. Russia, 2 (1897), No. 5, pp. 73–78*).

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[1] Centbl. Bakt. u. Par., 2. Abt., 1 (1895), pp. 97, 160.

Study of the soils of Russia, N. SSIBIRZEFF (*Mém. Congrès. Géol. Internat., 1897, No. 5, pp. 73–125*).

Soil temperatures with and without coverings of plants and snow, H. WILD (*Mém. Acad. Impér. Sci. St. Pétersbourg, 8. ser., Classe Phys. Math., 5 (1897), No. 8*).

Sampling of soil for analysis, H. LAGATU (*Prog. Agr. et Vit., 28 (1897), No. 47, pp. 603–606, fig. 1*).—A trench is dug to a depth of 0.6 meter. On the vertical side of this the character of the different soil layers is noted. A rectangular section is first taken to a depth of 0.3 meter, mixed, and from it a 2 kg. sample taken. The next 0.3 meter of the section is sampled in the same way and ordinarily taken as representing the subsoil. The latter rule is varied if the preliminary examination shows the soil to vary sharply at less than 0.3 meter. More than 2 kg. is necessary in very rocky soils.

Sampling of alkaline soils, E. W. HILGARD and R. H. LOUGHRIDGE (*Ann. Sci. Agron., 1897, II, No. 3, pp. 394–431, dgms. 6*).—A translation by J. Vilbouchevitch of an article in the Annual Report of the California Station for 1894–'95, p. 37 (E. S. R., 8, p. 677), entitled "The distribution of the salts in alkli soils."

Nitrogen and forest growth, E. HENRY (*Ann. Sci. Agron., 1897, II, No. 3, pp. 359–381*).—A general discussion, based mainly upon the work of others, of the causes of gain or loss of nitrogen in forest soils, especial attention being given to fixation of nitrogen by micro-organisms. It is shown that forest soils are enriched in nitrogen and mineral matter.

Moors and moor culture in Bavaria, A. BAUMANN (*Forstl. Naturw. Ztschr., 6 (1897), No. 2, pp. 393–409; 7 (1898), No. 2, pp. 49–72, pl. 1, figs. 2*).

On culture trials on marshy soils at Herrenäs (Finland), M. VON ESSEN (*Biet, 18 (1897), No. 12, pp. 323–335*).

On so-called poor soils and the crops they can produce, I. G. AGARDH (*K. Landt. Akad. Handl. Tidskr., 36 (1897), No. 5, pp. 267–287*).

Influence of forests on subterranean water, P. OTOTZKY (*Ann. Sci. Agron., 1897, II, No. 3, pp. 455–477, pls. 2*).—This is a translation from the Russian giving the results of a hydrological survey in the steppes region. The conclusion is reached that, physico-geographical conditions being the same, the level of ground water is lower in the forests than in the adjacent steppes or in general in neighboring open spaces. The level falls as forests are approached, the fall sometimes being very sudden, and it is more marked in case of old forests than new. It was noted also that at the surface of the ground water had an incline opposite that of the soil.

FERTILIZERS.

Absorptive powers of litter for ammonium carbonate, N. PASSERINI (*Ann. R. Acad. Georgifili, 20 (1897); abs. in Ann. Agron., 24 (1898), No. 2, p. 92*).—Instead of testing the absorptive power with water, as is usually done, the different kinds of litter, straw of cereals and leguminous plants, leaves of trees, peat, etc., were treated with a solution of ammonium carbonate of known strength, kept for two hours in a closed flask and the amount of ammonium carbonate absorbed noted. The cereal straws showed a low absorptive power, although varying greatly among themselves, barley, oat, and rice straw having the highest absorptive power. Cutting or grinding had but little effect upon the absorptive power of wheat straw, but increased that of cornstalks seven times. The absorptive power of the litter of leguminous plants was much greater than that of cereal straws; that of the leaves (except pine straw) was still higher, due, according to the author, to the acid (tannin, etc.) they contain. Wood moss ranked with leaves in absorptive power, and peat of good quality stood at the head of the list.

Analyses of commercial fertilizers, L. L. VAN SLYKE (*New York State Sta. Bul. 129, pp. 351-421*).—Of the 735 samples, representing 500 different brands of commercial fertilizers collected during the spring of 1897, 400 were complete fertilizers. The average composition of the latter is shown in the following table:

Average composition of complete fertilizers.

	Per cent guaranteed.			Per cent found.			Average per cent found above guarantee.
	Lowest.	Highest.	Average.	Lowest.	Highest.	Average.	
Nitrogen	0.40	8.78	2.09	0.30	8.08	2.23	0.14
Available phosphoric acid	1.93	11.00	7.63	.83	19.68	8.44	.81
Insoluble phosphoric acid				.10	8.06	2.19	
Potash	.14	19.00	4.30	.08	15.58	4.57	.27
Water-soluble nitrogen				.01	6.25	.95	
Water-soluble phosphoric acid				.20	12.47	4.97	

"In 293 brands of complete fertilizers the amount of nitrogen found was equal to or above the guaranteed amount, the excess varying from 0.01 to 2.73 per cent, and averaging 0.30 per cent. In 107 brands the nitrogen was below the guaranteed amount, the deficiency varying from 0.01 to 2.25 per cent and averaging 0.29 per cent. In 87 cases the deficiency was less than 0.5 per cent. . . .

"In 326 brands of complete fertilizers the amount of available phosphoric acid was above the amount guaranteed, the excess varying from 0.01 to 10.68 per cent and averaging 1.14 per cent. In 74 brands the available phosphoric acid was below the guaranteed amount, the deficiency varying from 0.01 to 3.06 per cent and averaging 0.58 per cent. In 49 cases the deficiency was below 0.5 per cent. . . .

"In 297 brands of complete fertilizers the amount of potash found was above the guaranteed amount, the excess varying from 0.01 to 4.41 per cent and averaging 0.53 per cent. In 103 brands the potash was below the guaranteed amount, the deficiency varying from 0.01 to 8.32 per cent and averaging 0.47 per cent. In 85 of these cases the deficiency was less than 0.5 per cent. In 88 cases among the 400 brands of complete fertilizers the potash was contained in the form of sulphate free from an excess of chlorids.

"The retail selling price of the complete fertilizers varied from \$15 to \$60 a ton and averaged \$28.92. The retail cost of the separate ingredients unmixed varied from \$1.80 to \$34.25 and averaged \$20.17, or \$8.75 less than the selling price."

Artificial fertilizers from apatite and similar mineral phosphates, G. E. BROMS (*Ugeskr. Landm., 42 (1897), No. 32, p. 421*).—The process of treatment consists in fusing the mineral phosphate with sodium carbonate, when tetra calcium-sodium phosphate is formed. This is insoluble in water, but easily soluble in ammonium-citrate solution. The reaction which takes place is as follows:

$$9\,CaO\,3\,P_2O_5+CaFl_2+3\,Na_2CO_3=$$

$$\left.\begin{matrix}10\ CaO\\ 2\ Na_2O\end{matrix}\right\}3\,P_2O_5+2\,NaFl+3\,CO_2.$$

The method has been patented in Sweden and Denmark, and patents have been applied for in other countries.—F. W. WOLL.

Fertilizer experiments in Smaalenene, Norway, F. H. WERENSKIOLD (*Norsk Landmansblad, 1896, No. 32, pp. 377, 378*).—The object of the experiments was to investigate the effect of lime on marsh and clay soils sown to oats. They were conducted on 7 different farms in Smaalenene district, Norway. The fertilizers applied were Thomas slag and nitrate of soda, with or without the addition of lime. The rather wet season, in connection with the (under the conditions) somewhat heavy application of nitrate of soda caused the oats to lodge on all farms. It was noticed that the oats on the limed plats lodged first, the lime evidently converting a portion of the nitrogen of the soil into available form, and thus acting like one-sided nitrogen fertilization.

The following table gives the average results for the 2 classes of soils as regards the yield and the chemical composition of the oats and oat straw produced.

Average results of liming oats.

	Character of soil.	Yield.	Composition.						
			Water.	Ash.	Fat.	Crude protein.	Crude fiber.	Nitrogen-free extract.	Digestible protein.
Oats:		*Kg.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per cent.*	*Per cent.*
Lime	Marshy	129.5	12.63	2.83	4.66	12.25	10.00	57.63	93.74
No lime	do	135.8	12.91	2.82	4.83	11.19	10.69	57.56	94.57
Lime	Clayey	116.3	13.78	2.82	5.34	10.05	11.39	56.64	93.29
No lime	do	116.0	13.91	2.81	5.29	9.69	11.14	57.16	93.57
Oat straw:									
Lime	Marshy	297.5	13.10	6.33	1.33	5.85	34.67	38.72	65.35
No lime	do	262.3	14.95	5.86	1.26	3.56	37.22	37.15	56.08
Lime	Clayey	278.1	14.76	6.58	1.80	4.64	32.75	39.47	62.04
No lime	do	191.9	14.21	6.10	1.90	4.16	32.22	40.41	63.07

—F. W. WOLL.

Some of the principles which should determine compensation for the use of foods and manures, R. WARINGTON (*London: Vinton & Co., pp. 44*).—This is a discussion based largely upon experimental work at Rothamsted and Woburn on the amount which should be paid by an incoming tenant to an outgoing tenant for permanent improvements due to use of fertilizers and feeding stuffs on the farm as provided for in the Act of Parliament of 1883.

On the preservation of barnyard manure, C. VON FEILITZEN (*Landtmannen, 8 (1897), No. 45, pp. 635–637*).

On the manufacture of peat litter, P. HAUGAN (*Tidsskr. Norske Landbr., 4 (1897), No. 11, pp. 511–514*).

Distributors of liquid manures, M. RINGELMANN (*Jour. Agr. Prat., 1 (1898), No. 5, p. 174*).

"Natural plant food;" claims made for it and its value, B. W. KILGORE (*Mississippi Sta. Bul. 43, p. 14*).—Analyses of this material are reported which indicate that it is a "low-grade natural phosphate of too poor a quality to be used in the manufacture of acid phosphates or other fertilizers." Such a phosphate can be bought at the mines for from $2 to $3 per ton, while the price asked for the so-called "natural plant food" was $11 to $17 per ton.

Analyses of commercial fertilizers, M. A. SCOVELL, A. M. PETER, and H. E. CURTIS (*Kentucky Sta. Rpt. 1896, pp. 83–96, 99–108*).—A reprint of Bulletins 64 and 65 of the station (E. S. R., 8, pp. 300, 970).

Analyses of commercial fertilizers, B. W. KILGORE ET AL (*Mississippi Sta. Spec. Buls. 42, pp. 15; 45, pp. 18*).—These bulletins include statements regarding the fertilizer control in Mississippi, explanations of terms used in reporting analyses of fertilizers, notes on valuation of fertilizers, lists of brands licensed for sale in the State with guaranteed analyses, and tabulated analyses and valuations of 93 samples of fertilizing materials collected during the latter part of December, 1897, and January, 1898.

Analyses of commercial fertilizers, W. C. STUBBS (*Louisiana Stas. Bul. 49, 2. ser., pp. 163–198*).—This bulletin gives the text of the State fertilizer law, discusses the nature and sources of the various fertilizing materials supplying nitrogen, phosphoric acid, and potash in fertilizers, and the valuation of fertilizers, gives a list of guaranteed analyses of fertilizers licensed for sale during the seasons of 1896 and 1897, and reports analyses of 171 samples of fertilizing materials, including ammoniated superphosphates and guanos, acid phosphates, cotton-seed meal, tankage, nitrate of soda, dried blood, bone, cotton-hull ashes, potassium sulphate, kainit, and "natural plant food."

Analyses of the last-named material "show beyond doubt that it is a natural phosphate, finely ground, mixed, perhaps with a small quantity of kainit."

The agricultural value of phosphatic slag, L. GRANDEAU (*Ann. Sci. Agron., 1897, II, No. 3, pp. 432–444*).—A general discussion of this subject, devoted largely to the work of Wagner, Maercker, Meissl, and Petermann and Graftiau, but including also results of experiments by the author on beans, potatoes, and maize, which lead to the conclusion that there is no relation between the solubility of a phosphate in acid citrate solution and its assimilation by plants. The author, therefore, recommends that slag be bought on guaranty of total phosphoric acid and fine meal.

American phosphates (*L'Engrais, 13 (1898), No. 8, pp. 180, 181*).—A statement of shipments from different American ports in 1897.

On the Russian phosphate deposits, R. GRIPENBERG (*Biet, 19 (1898), No. 1, pp. 10–12*).

The deposits of phosphate of lime in Algeria, L. GRANDEAU (*Ann. Sci. Agron., 1897, II, No. 2, pp. 213–260*).

On the action of phosphoric acid in field experiments with Thomas slag and ground bone, E. MEISSL and REITMAIR (*Ztschr. Landw. Versuchsw. Oesterr., 1 (1898), No. 1, pp. 78–88*).

Artificial fertilizers, H. JUHLIN-DANNFELT (*K. Landt. Akad. Handl. Tidskr., 36 (1897), No. 4, pp. 203–235*).

A bill governing the sale of fertilizers, feeding stuffs, and seeds (*Tidskr. Landtmän, 18 (1897), No. 38, pp. 679–684*).—The text of a bill introduced in the Swedish Parliament, with discussions of the same.

FIELD CROPS.

Second report on potato culture, I. P. ROBERTS and L. A. CLINTON (*New York Cornell Sta. Bul. 140, pp. 385–390, fig. 1*).—This work is in continuation of experiments made in 1895 and 1896 (E. S. R., 9, p. 343). The results for the three years are given in tables.

The soil upon which the experiments were made contained about one-half the total amount of plant food carried by an average soil and in consequence the authors ascribe the satisfactory results obtained to the culture and treatment of the crop. The land was plowed April 2 and 3, as early as the conditions of the soil permitted, and between the time of plowing and planting the soil was brought to a superior condition of tilth and a soil mulch established by harrowing frequently. All plats were planted May 7. The rows were 40 in. apart and single pieces of seed were planted 14 in. apart in the row. Large marketable potatoes, free from scab and as perfect as could be obtained, were selected for seed, and the cuttings were made of good size, with 1 or 2 strong eyes to each cutting. The practice of using parings or single eyes or buds for seed and the use of small potatoes for the same purpose is discouraged.

The following table gives the results for this season:

Yield of potato plats for 1897.

No. of plat.	Variety.	Number of cultivations.	Number of sprayings with Bordeaux mixture and Paris green.	Total yield per acre.
				Bushels.
34	Carman No. 3	8 level	4	384
35	do	do	4	357
36	do	5 level	4	349
37	do	do	4	325
38	do	5 hilled	4	288
39	Rural New Yorker No. 2	5 level	None.	234
40	do	do	4	305
41	do	7 level	4	347
42	Rose of Sharon	do	4	320
43	do	5 level	4	311

In 1896 forage crops were grown on all the plats, except on plat 34, on which spurry was grown, the first and second crops being plowed under. After the second plowing the spurry reseeded again and was left as a cover crop. The large yield of this plat is credited to its better treatment. Plats 37 and 38 were treated alike, except that at the last cultivation plat 37 was left level and plat 38 was hilled. There was a difference in yield of 37 bu. per acre in favor of level culture.

"The general results with culture verify the results obtained in 1896, *i. e.*, that in the ordinary season about 7 to 9 cultivations with a fine-toothed implement are likely to give best results."

Sugar beets in Michigan in 1897, C. D. SMITH and R. C. KEDZIE (*Michigan Sta. Bul. 150, pp. 123–158, figs. 6, map 1*).—This bulletin gives reports of experiments with sugar beets at the station and of cooperative experiments made by farmers throughout the State. Results of numerous analyses are tabulated, notes on the soil and climatic conditions for sugar beets are given, and a number of varieties of beets are described. The mean weekly temperature and rainfall for the beet season is given in a table.

At the station plats of well-drained, sandy loam soil were plowed 8 in. deep on April 17, followed by a subsoil plow which loosened the soil from 8 to 10 in. below the furrow. After the soil had been brought to a fine tilth, the beet seed was planted on May 8 in rows 22 in. apart. Cultivation was given with the Breed Weeder May 17, before the plants had appeared on the surface, and with 1-horse cultivators June 1, 12, and 21. At the time of the last cultivation the beets, then showing the fourth leaf, were thinned to 1 plant every 8 in. Corn had been grown on the plats the year before, and prior to that the land had been a meadow for 3 years.

The following table gives the results obtained:

Yield of sugar beets.

Variety.	Yield per acre.	Sugar content.	Coefficient of purity.
	Pounds.	*Per cent.*	
Wohanka	23,615	15.22	86
Improved Kleinwanzlebener	25,678	16.40	91
Original Kleinwanzlebener	27,368	18.27	94
Government Kleinwanzlebener	25,648	17.78	94
La Plus Riche	29,205	18.78	92
Government Kleinwanzlebener	32,327	17.78	94
Hoerning Improved	24,500	15.20	89
Floto Improved	20,200	13.21	88
Kleinwanzlebener on muck	....	12.96	75

An acre of beets required the labor of a man and team for 36.15 hours, and of a man for 209.9 hours. The hand work in harvesting, which required 130.75 hours, was performed by boys at 8 cts. per hour. Hoeing and thinning required 79.15 hours, and was done by men at 12½ cts. per hour. The work of a man and team was reckoned at 25 cts. per hour. At this price the cost of growing an acre of beets is estimated at $29.40.

From 64 counties in the State 493 samples were received, 465 of which had been grown on suitable soil and from proper seed. These showed an average sugar content in the beet of 16.4 per cent, with an average coefficient of purity of 84. The results obtained in the different counties are shown on a map. The yields are considered to have ranged from 12 to 18 tons per acre.

The fertilizer requirements of the sugar beet, the value of beet pulp as food for stock, and the requirements of a factory are briefly discussed. An act passed by the Michigan legislature for the encouragement of beet-sugar manufacture is given in the bulletin.

Field experiments with wheat, J. F. HICKMAN (*Ohio Sta. Bul. 82, pp. 213–235*).—The work consisted of a comparison of varieties and investigations of different methods of culture. The results are tabulated and discussed.

The relative merits of the red and white and the smooth and bearded varieties of wheat are discussed. The names of the white and the smooth wheats are given, all others considered in the bulletin being red or amber in color or bearded. The different names under which some of the varieties are believed to occur are given.

Eighty-four varieties of wheat were tested. Among 40 varieties grown continuously for 4 years Red Fultz, Poole, Nigger, Geneva, Mealy, New Monarch, Democrat, Deitz, Egyptian, Rudy, Japanese, Early Ripe, American Bronze, Valley, and Tuscan Island gave a greater average yield than the nearest plat of Velvet Chaff, the variety grown as a standard of comparison. Of these varieties, Mealy averages 4.32 bu. and Red Fultz 3.19 bu. more per acre than the standard variety; the other varieties mentioned yielding less than 3 bu. per acre more. The author reports Mealy, Red Fultz, Nigger, Geneva, and New Monarch to have given the best results in a series of tests, and recommends Velvet Chaff for the black soils, and Poole, Mealy, Red Fultz, Nigger, Deitz, and Rudy for the higher, and especially the clay, soils. The Rudy and Nigger varieties are not considered to be adapted to thin or wet lands. Varieties of wheat brought from the Northwest were not very successful. There was no superiority of one class of wheat over another as shown by the average yield.

The experiments with different methods of culture are described in detail, and directions for treating the seed to prevent smut are given.

From these experiments the author draws the following conclusions:

"Three successive crops, grown under adverse conditions, show that the heavier the seeding, under such conditions, up to 10 pecks per acre, the better the yield.

"From experiments made up to date it is recommended to sow in southern Ohio during the last week of September and the first week of October, but in northern Ohio from ten days to two weeks earlier.

"Compacting the seed bed before drilling seems to be the better plan on the clay as well as on gravelly or more open soils.

"A single trial of cross drilling with the same quantity of seed did not give any higher yield than where it was drilled but one way.

"One trial of cross drilling, using 3 pecks one way and 5 the other, gave less bushels per acre than 6 pecks drilled one way.

"Top-dressing the wheat ground six weeks before seeding, added materially to the yield, above the same kind and amount of top-dressing applied one week before seeding.

"Ground manured during the winter direct from the stable for corn and another piece manured just before plowing in the spring gave higher yields of oats from the earlier application of manure and lower yields of wheat following the oats.

"Slightly higher yields of wheat have followed the disking corn ground for oats than where the ground was plowed for oats, but that difference was more than overcome by a higher yield of oats from the plowed ground, and the lighter work of plowing again in the fall.

"The degeneration from sowing seed not selected is remarkably slow and not absolutely determined by our experiments thus far."

The requirements to be fulfilled for producing a good malting barley, P. BOLIN (*Landtmannen, 8 (1897), No. 4, pp. 564–569*).

Investigations on potash manuring in barley culture, T. REMY (*Wchnschr. Brau., 14 (1897), Nos. 50–52, p. 610; abs. in Chem. Ztg., 22 (1898), No. 9, Repert., p. 20*).—The conclusion is drawn that a liberal application of potash fertilizers on soils poor in that constituent increases the yield and enables the crop to more fully utilize the nitrogen present in the soil.

Carrot culture, LILIENTHAL (*Landw. Wchnbl. Schleswig-Holstein, 48 (1898), No. 8, p. 141*).—Directions for the culture of carrots with reference to soil, rotation, manuring, cultivation, harvesting, and their uses for feeding.

The superiority of superphosphate on cereals in spring, MAIZIÈRES (*L'Engrais, 13 (1898), No. 8, pp. 178–180, fig. 1*).—A popular discussion of this subject.

Guinea corn (Sorghum vulgare), J. SHORE (*Jour. Jamaica Agr. Soc., 2 (1898), No. 3, p. 100*).—Descriptive and cultural notes, with suggestions as to its use for feeding.

Grasses and clovers, H. A. DREER (*Philadelphia: H. A. Dreer, 1897, pp. 123, figs. 61*).—A handbook on forage and root crops, with directions for the making of lawns and their management. Numerous varieties of grasses, clover, and other forage crops are described in short notes.

The breeding of grain, J. H. MANSHOLT (*Deut. Landw. Presse, 25 (1898), No. 16, pp. 175–177, figs. 3*).—A discussion on grain breeding and descriptions of new varieties of wheat originated by the author.

Irrigated meadows (*Mitt. Deut. Landw. Gesell., 1898, Sup. No. 1, pp. 1, 2*).—A description of the formation and management of certain irrigated meadows in Russia.

Winter pasture, E. R. LLOYD (*Mississippi Sta. Bul. 44, pp. 4*).—Notes on crops of hairy vetch, turf oats and hairy vetch, and alfalfa grown at the station, giving directions for their culture and use. In every case the crops were used for hay or forage after having been pastured during the winter.

An experiment with new varieties of potatoes, A. PETERMANN (*Bul. Sta. Agron. Gembloux, 1898, No. 64, pp. 14–17*).

Potato experiments, M. A. SCOVELL (*Kentucky Sta. Rpt. 1896, pp. 3–13, 36–42*).—Reprinted from Bulletin 61 of the station (E. S. R., 8, p. 121).

On the possibility of the profitable culture of sugar beets on alkaline soils, E. W. HILGARD and R. H. LOUGHRIDGE (*Ann. Sci. Agron., 1897, II, No. 3, pp. 382–393*).—A translation by J. Vilbouchevitch of an article in the report of the California Station for 1894–'95, p. 71 (E. S. R., 8, p. 683), entitled "The growing of sugar beets on alkali soils."

A new method of growing sugar beets in hills, G. DUREAU (*Jour. Agr. Prat., 62 (1898), No. 10, p. 351*).—The advantages of the method are pointed out and the results of experiments are discussed.

Recent experiences in the culture of sugar beets, S. FORSBERG (*K. Landt. Akad. Handl. Tidskr., 36 (1897), No. 4, pp. 235–256*).

Raising and feeding sunflowers (*Amer. Agr. (mid. ed.), 61 (1898), No. 12, p. 358*).

Tobacco, M. A. SCOVELL and A. M. PETER (*Kentucky Sta. Rpt. 1896, pp. 61–68*).—Reprinted from Bulletin 63 of the station (E. S. R., 8, p. 302).

HORTICULTURE.

Indoor lettuce culture, W. STUART (*Indiana Sta. Bul. 66, pp. 39–58, pls. 2, fig. 1*).—A test of fertilizers in forcing lettuce is reported. The plants were grown in a black loam soil obtained from a plat of ground on which various crops had been grown without having received any fertilizers for a number of years. The plants were subwatered throughout the entire test. The bench, 19 ft. long by 3 ft. 9 in. wide, was divided into six sections. Various fertilizers were applied alone and in various combinations to the different sections, two sections receiving no fertilizer, one section muriate of potash, one muriate of potash and nitrate of soda, one muriate of potash and dissolved boneblack, and one muriate of potash, dissolved boneblack, and nitrate of soda. Muriate of potash was applied at the rate of 1,026 lbs. per acre, nitrate of soda and dissolved boneblack each at the rate of 1,503 lbs. per acre. The method of growing the plants and the amount of fertilizer applied to each section of the bench are given. Two crops were grown successively on the same soil with but one application of fertilizers. The plants of the first crop were measured about a month after being set in the bed and were harvested and weighed twelve weeks after being set. Those of the second crop were measured four weeks and weighed ten weeks after being set in the bed. In the second crop no attempt was made to grow large heads, the plants being set very close together. The results are given in tables and illustrated by diagrams and figures from photographs. The following table gives the average height and weight of plants grown with the different fertilizers:

Effect of large quantities of different fertilizers on forcing-house lettuce.

Kind of fertilizer.	Average height of plants.		Average weight of plants.	
	First crop.	Second crop.	First crop.	Second crop.
	Inches.	*Inches.*	*Grams.*	*Grams.*
None	2.64	2.05	22.66	13.00
Muriate of potash	2.26	1.92	19.83	16.42
Muriate of potash and nitrate of soda	2.30	1.61	11.05	9.11
Muriate of potash and dissolved boneblack	3.35	3.82	70.60	30.89
Muriate of potash, nitrate of soda, and dissolved boneblack	3.34	2.95	82.29	44 71

The author gives the following summary of the experiment:

"The application in large quantities of muriate of potash to a soil having a moderate amount of phosphoric acid caused a large decrease in yield in the first crop and without additional fertilizers an increase in the second. The addition of both muriate of potash and nitrate of soda in excessive amounts caused a very large decrease in the first crop, with a less marked one in the second. Dissolved boneblack and muriate of potash when applied in excessive amounts gave a very marked increase in the first crop, with a considerably less marked one in the second. The application of all three fertilizers in excessive amounts gave a very large increase in the first crop, with almost as large a one in the second. The dissolved boneblack and muriate of potash gave the plant the quickest start, as in each crop the plants in that section were considerably larger than in the others. Phosphoric acid seems to be an essential factor in the growth of lettuce."

To discover whether the percentages of moisture and ash in the plants had any relation to the weight of the plants or to the fertilizers used, determinations were made of the moisture and ash of mature plants from the first crop. The results of the determinations are given in the following table:

Relation of fertilizers and yield to percentages of ash and moisture content of lettuce.

Kind of fertilizer.	Average weight of plants.	Moisture.	Ash.
	Grams,	*Per cent.*	*Per cent.*
None	22.66	96.22	21.72
Muriate of potash	19.83	96.35	23.86
Muriate of potash and nitrate of soda	11.05	95.34	22.54
Muriate of potash and dissolved boneblack	70.60	97.63	24.19
Muriate of potash, nitrate of soda, and dissolved boneblack	82.29	98.18	24.37

Two tests were made to determine the effect of forcing lettuce in pots. In the first test Grand Rapids and White Seeded Tennisball lettuce were grown. Two weeks after the seed was sown the young plants that were to be grown in pots were transplanted into 2½ in. pots, and those that were to be grown in the open were transplanted into flats. Between 2 and 3 weeks later the plants were set in a bed, where they remained about 10 weeks. At the time of transplanting into the bed the White Seeded Tennisball plants grown in flats were about 26 per cent higher than those grown in pots, and the Grand Rapids plants grown in flats about 13 per cent higher than those grown in pots. At the time of harvesting the crop the average weight of the White Seeded Tennisball plants grown without pots was 60.32 gm., and that of the ones grown in pots was 48.76 gm. The Grand Rapids plants grown without pots averaged 154.8 gm. in weight and those grown in pots averaged 107.22 gm. In the second test Grand Rapids lettuce was used alone. Instead of transplanting part of the young seedlings into flats, as was done in the previous test, all of them were potted. When placed in the permanent bed, part of the plants were removed from pots and the others were plunged in soil with the pots, as in the first crop. The two lots of plants were of equal size when set in the bed. The plants remained in the bed about seven weeks. When harvested the plants grown without pots had an average weight of 203.03 gm.; those grown with pots an average weight of 150.6 gm.

A test was made to determine whether lettuce plants when set 8 in. apart yield as much in weight per square foot as when set 6 in. apart.

"The result of this comparative test was very much in favor of the close planting, a yield of 567 gm. per square foot being obtained from those set 6 in. apart as against 313 gm. from those 8 in. apart, making a gain in favor of the former of over 80 per cent. It should be said, however, that the plants were marketed when those set 6 in. apart were commencing to crowd each other for space, hence those set 8 in. apart had not grown as large as they probably would have done if allowed to remain longer."

To test a supposition that lettuce plants lose weight by "bleeding" when cut from the roots in marketing, some plants were cut off even with the soil and others were pulled up. The plants were weighed, washed, prepared for market, and left in a warm room for 6 hours, when they were again weighed. As to results the author says:

"The only indication given by this experiment is that it matters little which method is practiced, especially if the plants are sufficiently mature, when probably little bleeding occurs."

The history of subwatering in greenhouses is briefly given. For three years the station tested a method of subwatering by means of drain tiles cemented together and laid in the bottom of a water-tight bench. The method was abandoned on account of the uneven distribution of water throughout the bed. A method adopted by the station is described. It is a modification of the one reported by the Wisconsin Station (E. S. R., 9, p. 557). A zinc pan 3 or 4 in. deep is fitted in the bottom of the bench and a layer of soft brick set edgewise in it to conduct the water to the soil above. The water is admitted by means of vertical tubes extending to the bottom of the pan. The lower edges of the bricks are chipped off to form channels for the freer distribution of water in the pan. At first the pan was provided with two overflows $1\frac{1}{2}$ in. above the bottom. Later water gauges were put in, so that the height of the water in the pan could be seen at any time. The method was found to be a very efficient means of distributing the water evenly. The expense of fitting a bench with this system of subwatering was 13 cts. per square foot. The author believes this additional outlay is more than counterbalanced by the increased yield, the lessened labor in attendance, and the greater durability of the bench.

Forcing tomatoes—comparison of methods of training and benching, S. A. BEACH (*New York State Sta. Bul. 125, pp. 275–304, figs. 3, pls. 6*).—The bulletin reports tests of different methods of benching and training tomatoes in forcing houses. Two tests were made in the winter of 1895–'96 and three in the winter of 1896–'97. In all the tests Lorillard tomatoes were used. All plants in each test were grown from the same lot of seed and were selected to give specimens as uniform as possible. Soils and fertilizers were uniform for all plants in each test, and other conditions, except the ones to be compared, were as nearly alike as possible. The seeds were germinated in flats and the seedlings transplanted into small pots, $2\frac{1}{2}$-in. pots in the first two tests and 2-in. pots in the third test. When set in the benches a part of the plants were removed from the pots and part were left in them, the soil being mounded up above the pots to the seed leaves of the plant. Part of the plants in pots and part of those not in pots were trained to single stems, and part of each were trained to three stems. Each single stem plant was allowed only half as much bench room as each three-stem plant, the areas in the different tests being $2\frac{1}{8}$, $2\frac{3}{8}$, and $2\frac{5}{6}$ sq. ft. for the former and $4\frac{1}{4}$, $4\frac{3}{4}$, and $5\frac{2}{3}$ sq. ft. for the latter.

A summary of the data secured in these tests is given in the following table:

Results of experiments with tomatoes.

Method of growing plants.	Number of plants.	Average time from seed planting to first ripe fruit.	Average number of fruits per plant.	Average weight of individual fruits.	Yield per square foot of bench.
First test.					
In pots:		*Days.*		*Ounces.*	*Ounces.*
Single-stem training	33	160.15	15.97	1.76	13.21
Three-stem training	17	159.17	24.94	2.04	11.74
Not in pots:					
Single-stem training	31	157.90	13.60	2.00	12.79
Three-stem training	17	160.15	25.35	1.93	11.52
Second test.					
In pots:					
Single-stem training	7	102.57	18.43	2.66	20.37
Three-stem training	6	96.00	27.83	2.72	15.96
Not in pots:					
Single-stem training	9	99.78	16.56	2.82	19.68
Three-stem training	7	97.00	27.86	2.79	16.37
Third test.					
In pots:					
Single-stem training	18	173.78	23.17	2.84	23.20
Three-stem training	9	168.89	37.11	2.45	16.04
Not in pots:					
Single-stem training	20	172.45	25.15	2.77	24.56
Three-stem training	10	171.30	44.40	2.49	19.53

Although the first fruits as a rule ripened somewhat earlier on the plants trained to three stems than on those trained to single stems, yet the amount of fruit ripened early in the test was greater in case of the single-stem plants than of the three-stem ones.

The author gives the following conclusions:

"Single-stem training is clearly superior to three-stem training for forcing tomatoes in winter in this climate. The superiority is seen in the larger yield of early ripening fruit and in the larger total yield. There is but slight difference in the average size of fruit produced under the two methods of training, but on the whole the fruit of the single-stem plants seems to be slightly the larger.

"Plants in 2 or 2½ in. pots plunged in the soil so that roots may be formed above the pot as compared with similar plants knocked out of the pots and planted in the soil on the bench sometimes show slight gain in yield when plants are trained to single stem, but this treatment is a disadvantage when plants are trained to three stems."

Variety tests with raspberries, blackberries, and dewberries, W. PADDOCK (*New York State Sta. Bul. 128, pp. 339–349*).—The results of the variety tests are recorded in tables, showing such data as yield, dates of first and last picking, percentage of early and late yield, etc. The test included 11 varieties of black raspberries, 22 of red raspberries, 7 of purple blackberries, 19 of blackberries, and 4 of dewberries. Descriptive notes are given on some of the newer varieties. The results of the tests are summarized as follows:

"Poscharsky No. 15 takes first rank among black raspberries, both as to total yield and the amount of fruit produced early in the season. Palmer has a long season, as it is classed with both early and late berries. Babcock No. 5 and Mills were the two most productive late berries.

"Of red raspberries, Pomona gave the largest early yield and ranks second in productiveness. Cline ripens most of the crop in a few days, and, as is usual with very early berries, is unproductive. Kenyon and Olathe were the most satisfactory late red raspberries. Of the mid-season varieties, Loudon, Cuthbert, and King deserve special mention.

"Shaffer and Columbian are as yet the two standard varieties of purple raspberries.

"Of blackberries, Dorchester, Success, New Rochelle, and Stone Hardy were the most productive in 1897. Dorchester and New Rochelle have not always been hardy here. Early King produced the largest early yield.

"Lucretia is as yet the only dewberry of importance in this section."

Strawberries in 1897, W. PADDOCK (*New York State Sta. Bul. 127, pp. 327–338*).—The bulletin reports a variety test of strawberries. A table is given showing the yield of 28 varieties of strawberries in one-year-old beds, with a comparative statement of the early and late yield of each variety. A second table compares the early varieties, and a third table the late varieties. In a similar way the bulletin records the data obtained from the test of 28 varieties grown in two-year-old beds. Descriptive notes are given on 26 of the newer varieties of strawberries. The following summary is given:

"Of strawberries in one-year beds Beder Wood was the most productive early berry. It is also a satisfactory general-purpose variety, as it took second rank as to yield among the kinds that were fruited in one-year beds. Marshall is worthy of a trial for fancy fruit. Glen Mary was the most productive berry and produced the largest late yield. None of the strawberries in two-year beds succeeded more than moderately well, owing, no doubt, to winter injury and an unfavorable growing season. Earliest produced the largest early yield, while Robinson was the most productive and gave the largest late yield."

Strawberries, L. R. TAFT and H. P. GLADDEN (*Michigan Sta. Bul. 148, pp. 51-63*).—Data obtained from the test of 90 varieties of strawberries are recorded in tables, showing the size, form, color, quality, and firmness of fruit; dates of bloom and of first and last fruits; and sex and vigor of plants. Descriptive notes are given on 42 varieties fruited for the first time at the station in 1897, and on 54 new varieties of 1896. The following are recommended: Varieties for the market grower—Bubach, Crescent, Haverland, Warfield, Parker Earle, Beder Wood, Sharpless, Clyde, Woolverton, Bird, Charlie, Greenville, Leroy, Snowball, and Weston; large-fruited varieties—Brandywine and Marshall; late varieties—Aroma and Eureka; varieties for home use—Brunette and Timbrell. Of the newer sorts the following are the most promising: Enormous, Kansas, Mary, Meridian, Ona, Sherman, and Thompson 103.

Subwatering, F. CRANEFIELD (*Amer. Florist, 13 (1898), No. 512, p. 974*).—Notes on methods of subwatering in greenhouses. The author states that it is not necessary to have the benches absolutely level in order to use successfully the brick method employed at the Wisconsin Station (E. S. R., 9, p. 557). A disadvantage of the tile method is that the water is not uniformly distributed.

Subwatering, W. J. GREEN (*Florists' Exchange, 10 (1898), No. 13, p. 341, fig. 1*).—The advantages claimed for subwatering of carnations are the thoroughness of watering, the saving of time in watering, and the production of better flowers and longer, stiffer stems.

Further notes on subwatering, J. C. ARTHUR (*Amer. Florist, 13 (1898), No. 513, p. 984*).

Application of heat to greenhouses, W. R. BEATTIE (*Florists' Exchange, 10 (1898), No. 13, pp. 314, 315, fig. 1*).—The article is reprinted from the Columbus Horticultural Journal.

Suitable fertilizers for fruit (*Florida Farmer and Fruit Grower, 10 (1898), No. 14, pp. 211, 212*).

The cultivation of American ginseng in Pennsylvania, G. C. BUTZ (*Pennsylvania Dept. Agr. Bul. 27, pp. 23, pls. 3, figs. 4*).—A popular bulletin on the culture and uses of ginseng.

Asparagus culture, P. CHERVIN (*Bul. Dir. Agr. et Com., 3 (1898), No. 6, pp. 57-62*).

Fertilizers for lettuce (*Amer. Gard., 19 (1898), No. 161, Sup. pp. VI-VIII, figs. 3*).—This paper consists of extracts from Bulletin 66 of the Indiana Station (see p. 1048).

Garden peas, S. MOTTET (*Rev. Hort., 70 (1898), No. 5, pp. 112-115, figs. 4*).

Tomato forcing—methods of training and benching, F. H. HALL (*New York State Sta. Bul. 125, popular ed., pp. 4, pls. 4*).—A brief popular review of Bulletin 125 of the station (see p. 1051).

Fruit culture in Denmark and Sweden, I. ILSENG (*Tidsskr. Norske Landbr., 4 (1898), No. 12, pp. 544-551*).

Seedling apples (*Gard. Chron., 3. ser., 23 (1898), No. 585, pp. 145, 146*).—A discussion of the improvement of varieties of apples by crossing.

The plum, A. H. PEARSON (*Garden, 53 (1898), No. 1375, pp. 263-266*).—A paper read before the Royal Horticultural Society (England), discussing culture and varieties of plums.

Third report upon Japanese plums, L. H. BAILEY (*New York Cornell Sta. Bul. 139, pp. 369-382, figs. 9*).—Notes are given on those varieties of Japanese plums that fruited at the station during the season of 1897. In regard to the merits of the Japanese plums the author says:

"I am still convinced that the Japanese plums have come to stay. By this I do not mean that they are destined to supplant the domestic and native plums, but that they are bound to supplement those types with varieties that are adapted to particular purposes and conditions. As a class they are vigorous, hardy, and productive in tree, and the fruit is handsome, long keeping, and covers a long season. Thus far they have been comparatively free from black knot, and until this year our trees have not been seriously attacked by the shot hole fungus or leaf blight. During the past season, however, this leaf blight has been much worse upon the Japanese varieties than upon the domesticas alongside them, and this, too, in spite of the fact that they were thoroughly sprayed. The leaves did not drop to any extent, however, even though they were badly riddled by the fungus."

Analyses of pomegranates, A. BORNTRAGER and G. PARIS (*Ztschr. Untersuch. Nahr. u. Genussmtl., 1898, No. 3, pp. 158–163*).—An extended study of the pomegranate, including composition of seed and juice, fresh and fermented. The authors do not think that Italian pomegranates are suitable for wine making on account of their low sugar content.

Strawberries, new and old, C. W. MATTHEWS (*Kentucky Sta. Rpt. 1896, pp. 45–57*).—A reprint of Bulletin 62 of the station (E. S. R., 8, p. 231).

Culture of hazelnut trees for fruit, P. MOUILLEFERT (*Prog. Agr. et. Vit., 29 (1898), No. 9, pp. 272–279, figs. 3*).

New Italian cannas, E. ANDRE (*Rev. Hort., 70 (1898), No. 5, pp. 108–110, pl. 1*).

The cyclamen, D. GUIHENEUB (*Garden, 53 (1898), No. 1373, pp. 210–213*).—A discussion of the classification and culture of the cyclamen.

Crown and terminal buds of chrysanthemums, W. MILLER (*Florists' Exchange, 10 (1898), No. 13, pp. 325, 327, 329, figs. 4*).—A discussion of the choice of flower buds of chrysanthemums to secure flowers for exhibition.

Ornamental bedding, H. HANSEN *Amer. Florist, 13 (1898), Nos. 511, pp. 913, 914; 512, p. 946; 513, p. 994, figs. 12*).

Orchards for commercial culture, R. M. GREY (*Florists' Exchange, 10 (1898), No. 13, pp. 329, 331*).

Report of the horticultural department of the experiment station at Albano, Sweden, 1897, E. LINDGREN (*K. Landt. Akad. Handl. Tidskr., 36 (1897), No. 4, pp. 257–265*).

SEEDS—WEEDS.

First Ohio weed manual, A. D. SELBY (*Ohio Sta. Bul. 83, pp. 248–400, figs. 71*).—In the preliminary part of the bulletin the author discusses the nature of weeds, methods of introduction and spread, the vitality of weed seeds, principal methods of weed destruction, and legislation needed for weed suppression. A descriptive illustrated list of various weeds arranged in sequence of families is given. The author discusses the occurrence of weed seeds as impurities of grass and other seeds, and calls attention to the necessity of seed inspection. Twenty-nine species of weed seed are reported as having been found in clover seed during the past three years, and seven species of weed seed were found in timothy seed offered for sale. The bulletin concludes with lists of roadside weeds compiled from information received in response to a request in Bulletin 59 of the station (E. S. R., 7, p. 690), the intention being to show the relative importance of the different roadside weeds.

On the destruction of wild mustard (*Bul. Sta. Agron. Laon, 1897, pp. 68, 69*).—The announcement of Bonnet that a solution of copper sulphate would destroy wild mustard and wild radish when growing among cereals without injury to the latter was tested at the station. It was found that 5 per cent solutions at the rate of 800 to 1,000 liters per hectare sprayed over grain fields early in the year destroyed the wild mustard but was without effect upon the wild radish and other weeds, although the plants were quite young. Evidently this strength of solution was not sufficient for the destruction of wild radish, etc. The leaves of the grain were slightly injured, but quickly recovered. No effect was noticed on alfalfa or clover sown with the cereal. A 15 per cent solution of iron sulphate may be substituted for the copper sulphate where it would be cheaper, but the 5 per cent copper solution is preferred. The cost of treatment where power spraying machines are used is given at approximately $2 per acre.

On the seeds and testa of some Cruciferæ, L. H. PAMMEL (*Amer. Mo. Micros. Jour., 18 (1897), Nos. 7, pp. 205–210; 9, pp. 269–274; 10, pp. 312–317, pls. 5*).—Notes are given on the seeds of *Brassica nigra, B. sinapistrum, B. alba, Sysimbrium officinale, S. altissimum, Lepedium virginicum, L. apetalum, Capsella bursa pastoris, Barbarea vulgaris*, and *Camelina sativa*.

Researches on germination, V. JODIN (*Ann. Agron., 23 (1897), No. 10, pp. 433–471*).—Notes are given on the latent life of seeds, their hydration, their chemical inactivity during the resting period, minimum amount of water necessary for the respiration of seeds, influence of an excessive proportion of carbon dioxid on germination, and minimum quantity and state of oxygen necessary for germination.

Concerning a considerable source of error in testing clover seed, M. GLOCKENTOEGER (*Landw. Vers. Stat., 49 (1897), No. 3, pp. 219–222, figs. 10*).—The author reports upon a possible source of error in testing clover seed, especially when tested in sand or soil seed beds, and shows that broken seed coats or malformations of the seedling may result in the nonappearance of from 0 to 46 per cent of the plants above the surface of the soil. The author reports upon 143 experiments and comments on the nature of the different seedlings as a result of injury.

Concerning the methods of seed testing, H. RODEWALD (*Landw. Vers. Stat., 49 (1897), No. 4–5, pp. 257–286, fig. 1*).—The principal part of this paper is taken up in the theoretical consideration of errors in seed testing and the discussion of formulas for the establishment of the limits of error. Experimental data are cited to prove the theoretical formulas. A form of seed-testing apparatus is figured and described in which the seed are germinated in porous cups. The temperature and moisture regulations are said to be under perfect control. Comments on the paper are made by J. C. Kapteyn.

Report of seed control station at Christiania, Norway, for 1896, B. LARSEN (*Christiania, 1897, pp. 8*).

Report of seed control station at Gothenburg, Sweden, July 1, 1896 to June 30, 1897, J. E. ALÉN (*Gothenburg, 1898, pp. 16*).

Notes on introduced weeds, J. B. DAVY (*Erythea, 6 (1898), No. 3, p. 26*).—The presence of *Centaurea solstitialis* and *Taraxacum officinale* as weeds is mentioned.

Bermuda grass in Arizona, J. B. DAVY (*Erythea, 6 (1898), No. 3, pp. 24, 25*).—Reports the Bermuda grass (*Cynodon dactylon*) as becoming troublesome in orchards, the seeds and rhizomes being distributed by irrigation ditches. The same is also true of Johnson grass (*Andropogon sorghum halepensis*).

Cuscuta and its destruction, G. HEUZÉ (*Jour. Soc. Agr. Brabant-Hainaut, 1898, No. 1*).

DISEASES OF PLANTS.

A bacterial disease of sweet corn, F. C. STEWART (*New York State Sta. Bul. 130, pp. 423–439, pls. 4*).—The author describes a disease which has been under observation for the past three years and which has caused considerable damage to sweet corn in the market gardens of Long Island. Certain varieties seem to be more subject to the attack than others, and losses of 20 to 40 per cent, and even of the entire crop, are reported. The affected plants wilt and dry up without any apparent cause, and this may take place at any stage during their growth, but is most liable to occur about the time of flowering. The leaves first wilt and then gradually wither. The time which elapses between the appearance of the disease and the death of the plant varies greatly. Sometimes the plants recover, or may seem to recover for a time, and later yield to the disease. Nothing abnormal appears about the roots or subterranean portions of the stem except where the plants have been dead for a considerable time. The most distinct character of the disease is revealed when the stem is cut lengthwise, when the fibro-vascular bundles appear as yellow streaks in the white parenchyma. If the stem is cut crosswise and the cut surface exposed to the air for a few moments a yellow, viscid substance exudes in drops. Examination of this substance revealed the presence of large numbers of bacteria, and it is to them that the disease is due. Pure cultures of the germ are easily obtained, the organism growing readily at temperatures of 21 to 28° C. in neutral media of beef agar, potato agar, and gelatin.

The organism is a short bacillus with rounded ends, usually occurring in pairs, with a plain constriction between the members. No spores have been observed, but old cultures have not been carefully examined and the absence of spores can not be definitely stated. The organism is motile, but not actively so. Its behavior on various culture media and its chemical, temperature, and light reactions are described.

The bacteria are always found in the vascular system, never occurring in the parenchyma cells, and they injure the vitality of the plant by plugging up the main water canals.

The identity of the bacillus is not fully established, but it is considered specifically different from that causing the disease of corn known as Burrill's disease, due to *Bacillus cloacæ*.

Inoculation experiments are reported in which it appeared that the soil or the seed may be sources of infection. Popcorn, field corn, oats, and teosinte proved not susceptible to the disease when subjected to soil and puncture inoculations. The author believes that the chief method of dissemination of the germ is through diseased seed. Another common way in which the germ is probably disseminated is by the use of manure from animals fed on the diseased stalks.

Soil treatments with lime and sulphur have proved of no benefit in preventing this disease. As far as practicable the planting of nonsusceptible varieties is recommended. The only other locality besides Long Island where this disease is known definitely to occur is Iowa, although it is probably of wide dissemination.

Notes on Ophibolus graminis (*Bul. Sta. Agron. Laon, 1897, pp. 63–66*).—This fungus attacks cereals between the ground and the first node, weakening the stem and causing it to fall over. The disease, which is known as black foot of wheat, has been rather severe in its attack. It is not confined to wheat, but rye and barley are also subject to its attack. A mild, moist winter is most favorable to the development of the fungus. The seed grain and chaff are said to be active agents in disseminating the disease, and treatment of the seed is of some value. However, attacks may follow the presence of the spores in the soil, etc.

Spraying with copper solutions are beneficial, or the dry powder, mixed with some chemical fertilizer, may be sown broadcast with good results. Experiments are to be conducted along this line, the application of copper being made with nitrate of soda and superphosphate in February. The estimated additional cost of such treatment for the disease is about 40 cts. per acre.

Smut and bunt, F. MADDOX (*Agr. Expts. Eastfield, Tasmania, 1897, pp. 72–84, figs. 3*).—The author gives the details of six years' experiments with smut and bunt of cereals. The experiments with bunt showed that it could be readily prevented by the use of different solutions of chemicals or by the hot-water treatment, but no method was learned for the prevention of the smut. He found in inoculation studies of the smut that the only means of securing infected grain was by putting spores on the ovary of the plant at the time of shedding the pollen by the flowers. Numerous experiments are reported in which no failures were secured if the smut spores were placed on the ovary at the proper time. It was found also that the period of ripening of the smut spores and that for the infection of the young grain closely corresponded. Numerous experiments were conducted by which it was sought to artificially produce disease on wheat, oats, and barley by inoculating them with spores of the smuts of wheat, oats, and grass, and wheat and barley bunt. The results of his inoculations are shown in tables. In no case were oat diseases conveyed to other plants, nor were they ever artificially induced on the oat plant. Successful inoculations were secured with the other plants.

A bacterial disease of the grape (La maladie d'Oleron), L. RAVAZ (*Ann. École Nat. Agr. Montpellier, 9 (1895–'96), pp. 298–317, pl. 1, figs. 14*).—Under the name of "La maladie d'Oleron," the author describes a disease of grapes which has been known for some time on the island from whence it takes its name. Lately the disease has been recognized in the vineyards of Charentes, Drome, and along the Mediterranean region. The disease is said to be of bacterial origin and to be readily communicated to unaffected vines. Its effect on the different parts of the plant is described. No part of the plant is free from attack, although the roots are the last to be invaded. The vessels of the diseased wood are often found crowded with short motile bacteria. These organisms are said to be easily isolated, are aerobic, and grow readily on gelatin or in Liebig's bouillon to which glucose is added. The bacteria are slightly larger in cultures than in the diseased tissues, are 1.5 to 2.5 μ with an average of about 2 μ in length, are somewhat dumb-bell shaped and are readily stained.

Inoculations made upon sound shoots readily induced the disease, and where the bacteria were introduced in considerable quantity the diseased condition was quickly recognizable.

Experiments for the prevention of the disease are reported in which iron sulphate and copper sulphate were compared, and it appeared that washing the vines with a 20 per cent solution of copper sulphate aided in preventing attacks of the disease.

The relation of this disease to other diseases of the vine which are considered to be of bacterial origin is discussed.

Description of Bacillus phaseoli, with some remarks on related species, E. F. SMITH (*Proc. Amer. Assoc. Adv. Sci., 46 (1897), pp. 288–290*).—An abstract is given of a paper read by the author at the Detroit meeting of the American Association for the Advancement of Science, August, 1897. The organism is described as follows:

"*Bacillus phaseoli*, n. sp., a short rod with rounded ends, yellow on various media, motile in early stages of growth, decidedly pathogenic to beans and some related legumes, and closely related to *Pseudomonas hyacinthi* and *P. campestris*. Its thermal death point is approximately 49° C., and it will not grow in the closed end of fermentation tubes in beef broth or peptone water with any of the ordinary sugars. It exerts a powerful diastatic action on potato starch. On bean pods it causes water-soaked spreading spots."

The organism has been under observation for more than a year and its parasitic nature unquestionably determined. The author presents the points of agreement and difference in tables so as to show the characterization of each of the above organisms.

Note on a tomato disease, S. A. BEACH (*New York State Sta. Bul. 125, pp. 305, 306, pl. 1*).—Descriptive notes are given by F. C. Stewart on a peculiar disease of tomatoes which was first noted in the forcing houses of the station. The disease has the general characters of the so-called black rot of tomato due to *Macrosporium tomato*, but examination revealed the total absence of fungus hyphæ in the tissues in the earlier stages of the disease, and at no time are there abundant bacteria in the diseased fruits.

In general the disease begins as a slightly depressed circular brown spot, which gradually enlarges, retaining its circular form, until it frequently covers half the surface of the fruit. Most frequently the spot originates at the blossom end, but it may originate at any point on the fruit. The spots are first brown in color, later becoming brownish black or greenish black, and are surrounded by light brown rings. The boundary line between the healthy and diseased tissue is conspicuously marked. The tissues within are blackened to a considerable distance below the surface and there is somewhat less than the normal amount of moisture present. There are no indications that either the stem or the leaves are attacked by the disease. Old specimens often show species of Fusarium, Penicillium, and various bacteria, but attempts made to cultivate in Petri dishes an organism from the diseased tissue developed nothing. If any organism is connected with this disease, it is one which does not readily grow in agar.

Investigations concerning potato scab, FRANK and KRÜGER (*Ztschr. Spiritusind., 19 (1896), Ergänzungsheft, pp. 9, pl. 1; abs. in Bot. Centbl., 73 (1898), No. 9, pp. 327, 328*).—The authors have made a study of the various forms of potato scab and some of the means for their prevention.

It is claimed that *Spongospora solani*, a rather common north European fungus, was not a constant accompaniment of the disease. Bolley's potato scab bacterium was not observed in any specimens. Thaxter's fungus, *Oöspora scabies*, was found abundantly. The authors are somewhat inclined to think the micro-organisms play a secondary rôle in the disease, the primary cause probably being some soil or other condition rendering the tuber susceptible of infection. Marling alone is said not to be the cause of this probable soil condition and the exact rôle played by marl is to be investigated further.

As preventive treatment the authors recommend soaking seed tubers in a 2 per cent Bordeaux mixture before planting.

A lily bulb disease, G. A. MASSEE (*Kew Misc. Bul. 122–123, pp. 87–90, pl. 1*).—This disease, brief mention of which has been given elsewhere (E. S. R., 9, p. 457 , is caused by a parasitic fungus, *Rhizopus necans*, illustrated descriptions of which are here given. It was first noticed on bulbs of *Lilium speciosum* and *L. auratum* from Japan. The fungus grows readily as a saprophyte in quite a number of culture media, fruiting in five or six days.

Culture experiments indicate that the fungus can not penetrate unbroken tissues and that it gains entrance to the bulbs through broken roots. It seems probable that the bulbs were not diseased when removed from the ground. A short immersion in a 1 per cent solution of salicylic acid or corrosive sublimate will destroy all spores on the bulbs. Onion bulbs are not subject to attacks of this fungus, but daffodils are, and it is said to have quite a range of dead and living hosts in Japan.

Precautionary measures, such as rotation of crops, avoidance of injury to roots, destruction of refuse, etc., are recommended for the prevention of the disease. When exported the bulbs should first be dipped into a solution of salicylic acid. They should also be allowed to thoroughly sweat before shipment.

Results of oat smut in 1897, C. P. CLOSE (*New York State Sta. Bul. 131, pp. 441–454*).—The author reports upon a series of experiments conducted for the prevention of oat smut. The methods tested were treatment of the seed with solutions of Ceres powder, lysol, formalin, potassium sulphid, and the Jensen hot-water treatment. Popular descriptions are given of the oat smut and methods of infection. The results of the different tests are tabulated and the cost of materials given. The hot-water treatment kept the crop wholly free from smut and none of the treatments injured the seed. Both sprinkling the seed with solutions and soaking them were tested. It was found that sprinkling the seed with a 1 per cent solution of either lysol or formalin entirely prevented the smut. The use of potassium sulphid did not entirely prevent smut attacks, and Ceres powder was found less effective. The results obtained by soaking the seed were similar to those just given. The cost per bushel of soaking the seed in a 0.3 per cent solution of lysol is about 2.7 cts.; in a 0.2 per cent solution of formalin, 1.4 cts.; in a 2 per cent solution of potassium sulphid, 5.4 cts., and in a 4 per cent solution of Ceres powder, 39.6 cts. The cost of the chemicals where the seed is sprinkled is 5 cts. per bu. for lysol, and 4 cts for formalin, a 1 per cent solution being used in each case. Weaker solutions were not tried, but it is thought they may prove effective in preventing the smut.

Conclusions of the Official Black Rot Commission, L. DEGRULLY (*Prog. Agr. et Vit., 28 (1897), No. 47, p. 590*).—The commission appointed by the Government of France to investigate the subject of black rot, at its meeting at Bordeaux on November 19, announced the following conclusions:

The experiments conducted during the summer of 1897 showed the efficiency of copper solutions for the prevention of black rot. Of the solutions tested Bordeaux mixture containing not less than 2 per cent copper sulphate gave the best results.

The first application should be made when the young shoots are from 10 to 15 cm. long. The efficiency of subsequent sprayings depends upon the time of their application. The vines should be sprayed before the different periods of attack, which, in Armagnac, in 1897, occurred May 18, June 7, and July 6 and 25. For the ordinary attack of black rot four or five sprayings will be sufficient. The removal of diseased leaves is recommended, and in the autumn all diseased tissues should be collected and burned.

Potato blights, I. P. ROBERTS and L. A. CLINTON (*New York Cornell Sta. Bul. 140, pp. 392–406, figs. 3*).—The early and late blights of potatoes are figured and popularly described. A report is given of spraying experiments, in which 3 applications of Bordeaux mixture and Paris green and one of Bordeaux mixture alone were given a number of plats of potatoes, and the average total yield of the sprayed plats was 337 bu., as compared with 234 bu. in the check plat. In the course of the experiments it appeared that different varieties of potatoes withstand attacks of these fungi to different degrees, Carman No. 3 being one of the most resistant, while Rose of Sharon was exceedingly susceptible to disease. Details are given for the preparation and application of the fungicides.

Spraying in 1897 to prevent gooseberry mildew, C. P. CLOSE (*New York State Sta. Bul. 133, pp. 489–500, dgm. 1*).—During the season of 1897 potassium sulphid, Bordeaux mixture, lysol, and formalin were tested side by side to determine their value for the prevention of the gooseberry mildew. The fungicides were applied at three different times, one lot receiving them just as the buds were opening, the second plats eleven days later, and the last sections twelve days after the applications to the previous sections. The first mildew appeared May 26 and by June 7 portions of the plantation were badly mildewed. At this time lysol and formalin seemed to have been without effect. Bordeaux mixture was more effective but not as good as potassium sulphid where the treatments were begun very early. The foliage was not injured by any of the fungicides. The cost of the solution of potassium sulphid, which gave the best results, was about 0.2 ct. per bush for seven applications. The station recommends the use of potassium sulphid solution (1 oz. to 2 or 3 gal. water) as the most effective fungicide for the prevention of gooseberry mildew. The methods of application are given in detail and the results of the treatment are tabulated.

The general appearance of the fungus is described, and as a rule it was generally found that the English varieties and their seedlings are more subject to attack by mildew than the American varieties.

Some aspects of vegetable pathology and the conditions which influence the dissemination of plant diseases, W. C. STURGIS (*Bot. Gaz., 25 (1898), No. 3, pp. 187–194, figs. 5*).

Mycological notes, B. D. HALSTEAD (*Bul. Torrey Bot. Club, 25 (1898), pp. 158–162, fig. 1*).—Notes are given on the hollyhock rust (*Puccinia malvacearum*), wind as a means of spreading rust, relation between rainfall and potato rot, and the Phytophthora of Lima beans.

Parasitic leaf fungi, A. S. WILSON (*Amer. Mo. Micros. Jour., 18 (1897), No. 12, pp. 365–372, fig. 1*).—Notes the occurrence and distribution of a number of the more common parasitic fungi.

The bean anthracnose, B. D. HALSTED (*Amer. Gard., 19 (1898), No. 169, p. 239, figs. 3*).—Briefly describes anthracnose of bean due to *Colletotrichum lagenarium* and recommends the use of Bordeaux mixture for its prevention.

Vegetable parasites of beets, H. BRIEM (*Bl. Zuckerrübenbau, 1897, Nos. 20, pp. 305–314; 21, pp. 321–331; 22, pp. 340–343*).

Concerning the winter forms of the cherry Monilia, FRANK and KRUGER (*Gartenflora, 47 (1898), No. 4, pp. 96–98*).

A disease of chestnuts in France, G. DELACROIX (*Bul. Soc. Mycol. France, 13 (1897), No. 4, p. 242*).

Concerning some fungus and insect enemies of coffee in Rio Janeiro, E. GOLDI (*Arch. Mus. Nac. Rio de Janeiro, 8 (1897), pp. 9–121, pls. 4*).

A probable cause of the so-called "malsania" of Corylus avellana, U. BRIZI (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 3–4, pp. 147–151*).—This disease has been usually attributed to attacks of fungi, several species of which are enumerated, but the author believes root galls cause considerable of the trouble. The origin of the galls is thought to be due to some small coleoptera.

A new blastomycete parasitic on the fruit of the filbert, V. PEGLION (*Atti R. Accad. Lincei, 294 (1897), p. 276*).

A disease of pears, J. NORMANT (*Monit. Vin., 1897, No. 95, p. 378*).

Concerning potato rots, E. ROZE (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 25, pp. 1118–1120*).—The author considers the potato rots under 2 divisions, the dry rots due to *Pseudocommis vitis* and *Micrococcus* spp., and the wet rots due to *Micrococcus* sp. associated with *Bacillus subtilis* and to *Phytophthora infestans*.

Insect and fungus pests of potatoes, H. GARMAN (*Kentucky Sta. Rpt. 1896, pp. 14–35, figs. 7*).—A reprint from Bulletin 61 of the station (E. S. R., 8, p. 136).

A bacterial disease of sweet corn, F. H. HALL (*New York State Sta. Bul. 130, popular ed., pp. 5, pls. 2*).—A popular summary of Bulletin 130 of the station (see p. 1056).

On rust on the small grains, J. SMITT (*Tidsskr. Norske Landbr., 4 (1897), No. 10, pp. 441–445*).—A résumé of J. Eriksson's results.

A new disease of wheat in Sardinia, A. N. BERLESE (*Bol. Not. Agr., 19 (1897), No. 13, pp. 430–437, figs. 2*).—The author gives the life history of the fungus, *Sphærođerma damnosum*, and an account of successful infection experiments. Ordinarily the fungus is saprophytic, but under some circumstances may become a destructive parasite.

The wheat eel (*Sächs. Landw. Ztschr., n. ser., 19 (1897), No. 34, pp. 480, 481, figs. 3*).—This nematode (*Tylenchus scandens*), which is from 0.8 to 1 mm. long, is found in the kernels of matured wheat, where it produces what is called "rade korn," which is without the power of germination. The only remedy noted is the sifting out of the diseased kernels.

An experiment with apple rot in 1896, H. GARMAN (*Kentucky Sta. Rpt. 1896, pp. XXXIV–XXXVI, pl. 1*).—Notes are given on an experiment with Bordeaux mixture applied to Janet apple trees for the prevention of rot of the fruit. Two trees were selected, one being used as a check. Eight applications were made. The weight of sound apples from the sprayed tree when the fruit was gathered, September 26, was 62 lbs. 4 oz., while those from the unsprayed tree weighed 8 lbs. 6 oz. As the result of the treatment the total yield of sound apples was increased more than seven times.

Results of experiments conducted in 1896 for the control of grape Peronospora, G. CUBONI (*Bol. Not. Agr., 19 (1897), No. 12, pp. 401–411*).—The results of experiments conducted in a large number of vineyards with various fungicides are reported. Bordeaux mixture, acetate of copper, sulphosteatite, copper-soda mixtures, copper sucrate, borol, etc., were tested with a view to securing some substitute for Bordeaux mixture. The results were negative in many cases and in others were very inferior to Bordeaux mixture. The experiments are to be repeated.

Influence of fertilizers on the disease and injuries of grapevines, P. COSTE-FLORET (*Prog. Agr. et Vit., 29 (1898), No. 10, pp. 300–308*).

Report of experiments for the prevention of black rot of grapes, MARRE and FOURNIALIS (*Prog. Agr. et Vit., 29 (1898), No. 6, pp. 183–188*).

On the use of corrosive sublimate against black rot, L. DEGRULLY (*Prog. Agr. et Vit., 29 (1898), No. 12, pp. 353–355*).—This fungicide is said to be as efficient as copper compounds for the prevention of black rot.

On the preparation and use of bichlorid of mercury solutions as fungicides, L. DEGRULLY (*Prog. Agr. et Vit., 29 (1898), No. 10, pp. 289–292*).

Best remedy for gooseberry mildew, F. H. HALL (*New York State Sta. Bul. 133, popular ed., pp. 6*).—This is a popular summary of Bulletin 133 of the station (see p. 1061).

Oat smut and new preventives, F. H. HALL (*New York State Sta. Bul. 131, popular ed., pp. 6*).—This is a popular summary of Bulletin 131 of the station (see p. 1060).

Formic aldehyde, G. L. TAYLOR (*Amer. Jour. Pharm., 70 (1898), No. 4, pp. 195–201*).—Notes are given on the preparation, analysis, and uses of this important germicide.

ENTOMOLOGY.

Food habits of North American Sesiidæ, W. BEUTENMÜLLER (*Bul. Amer. Mus. Nat. Hist., 9 (1897), pp. 217–220*).—The following food habits are noted: *Melittia satyriniformis* lives in the roots and lower parts of the stems of squash vines and probably other allied plants; *M. gloriosa*, roots of sumac and the herbaceous climbing stems of Megarrhiza; *Alcathoë caudatum*, roots of virgin's bower (*Clematis virginiana*); *Sannina uroceriformis*, roots of the persimmon; *Trochilium pacificum*, bores in the cottonwood and probably also the willow; *T. tibiale*, the trunks of poplar and willow; *T. apiforme* (a European species), breeds in the roots and lower parts of the trunks of poplar and willow; *Bembecia marginata*, roots of the blackberry and raspberry; *Vespamima sequoiæ*, breeds in the California redwood (*Sequoia sempervirens*) and pines (*Pinus lambertiana* and *P. ponderosa*) producing thick excrescences on the branches and trunks; *Sciapteron tricincta*, in the canes and trunks of low swamp willows infested with *Cryptorhynchus lapathi* and *Saperda concolor*, also in the poplar; *S. denotata*, habits probably the same as last species; *S. robiniæ*, the locust (*Robinia pseudacacia*), also recorded in the poplar; *S. simulans*, in the solid wood of the trunks of red oak; *S. dollii*, in the solid wood of poplar and also possibly the willow; *S. polistiformis*, burrows in the bark and sapwood of both wild and cultivated grapevines; *Tarsa denudata*, in the roots and lower parts of the trunk of alder and ash; *Parharmonia pini*, under the bark of pine; *Podosesia syringæ*, the trunks of lilac, ash, and mountain ash; *P. fraxini*, the trunks of the ash and probably also the lilac; *Sannina exitiosa*, under the bark of the peach and cherry, both wild and cultivated, at the base of the tree and very often beneath the surface of the ground; *S. opalescens*, feeds like the preceding species, in the trunks of the peach and apricot and probably also the cherry; *Sesia rutilans*, in the roots of the strawberry, blackberry, and raspberry; *S. bassiformis*, in the stalks of Eupatorium; *S. rubrofascia*, in the trunks and canes of willow; *S. albicornis*, habits like the last; *S. culiciformis americana*, in Nevada in the trunks and stems of alder; *S. acerni*, bores under the bark of the maple, especially *Acer dasycarpum; S. corni*, under the bark of maple; *S. tipuliformis*, in the stems of the cultivated currant, in Europe in the young shoots of hazel; *S. pyri*, in the trunks of pear and apple, between the outer bark and sapwood; *S. scitula*, under the bark of chestnut, oak, and dogwood, likewise in the oak galls (*Andricus cornigerus*), and in galls on willow and hickory; *S. rubristigma*, bred from the oak gall (*Andricus cornigerus*); *S. sigmoidea*, taken from willow; *S. querci*, bred from galls found on live oak in Arizona; *S. prosopis*, raised from galls found on mesquite in Arizona; *S. pictipes*, under the bark of plum, cherry, peach, plum, chestnut, and juneberry (*Amelanchier canadensis*); usually bores under the bark some distance up from the base; it also feeds in the black knot fungus;

Pyrrhotænia floridensis, moths have been taken on scrub oak, and it is thought that the larvæ may feed on this tree.

Two insect pests of 1896, J. H. PANTON (*Rpt. Ontario Ent. Soc., 1896, pp. 44–54, figs. 12*).—The two insects noted are the army worm (*Leucania unipuncta*) and the tussock moth (*Orgyia leucostigma*). A map shows the distribution of the first; 39 counties and 118 townships were affected. Of the crops attacked 58 per cent were oats, 20 per cent corn, 16 per cent wheat, and 5 per cent barley. In some cases the loss in oat fields was reported to be 50 per cent, but in most cases the damage was comparatively slight. In a few cases the whole crop was destroyed.

Observations made on the rate of travel while crossing a lane between two fields showed that they moved at the rate of 40 rods per hour.

The following summarizes experiments with several food plants: Clover, eaten very sparingly, quickly left for wheat or oats; lucern, less attractive, not touched for four days; with clover, beans, and lucern in the same box, hunger drove the worms to eat beans first, clover second, and alfalfa last. Peas were not touched for two days, or not as long as oats were accessible. Turnips, left untouched for a day, deserted as soon as a leaf of corn was put in the box. Potatoes, left untouched. Mangel-wurzels near one of the infested fields escaped damage, though the worms were constantly passing over and among them. In the box they were slightly nibbled. Beets, untouched for three days. Buckwheat tried after the first day, immediately left for corn when this was presented to the worms. Carrots, not eaten for a day, but at the end of the second day were fairly well eaten; not touched in presence of grass or corn. Cucumber vines, preferred to beans, eaten almost as greedily as some corn leaves. Celery, always avoided, the worms devouring one another before they would feed upon it. Maple leaves were avoided. Apple leaves, sparingly eaten after two days. Grape leaves, eaten when driven by hunger. Strawberry leaves, not touched until the third day. Currant leaves, eaten sparingly after three days. Canadian thistles remained untouched. If no food was put in the box containing caterpillars, they began devouring one another within twenty-four hours. It appears from these experiments that the insect decidedly prefers the Gramineæ, and that it will not feed upon leguminous plants and some other orders unless compelled by hunger.

Among the natural enemies are mentioned *Calosoma calidum*, *Harpalus calignosus*, *Tachina flavicauda*, *Ichneumon leucaniæ*, and *Ophion purgatus*. The usual remedies, such as furrowing, spraying with Paris green (1 lb. to 75 gal. water), rolling, spraying with kerosene emulsion, and burning windrows of straw after the insects have concealed themselves therein are noted.

Report of the entomological section, C. P. GILLETTE (*Colorado Sta. Rpt. 1897, pp. 55–61*).—The author notes some experimental work undertaken for the purpose of throwing light on the life history of the cutworm and other night-flying moths. It is found as a rule that male and female moths are attracted to light or sugar in about equal numbers, and that males fly for a few days or even for as much as a week before the female of the same species. The females are much more readily captured before the deposition of eggs than after.

Data were also collected on the relative value of different remedies against the codling moth, and it was concluded that bandages employed for the destruction of the larvæ may be of great service, while but slight protection is obtained by destroying the fallen infected fruit.

The author also gives notes on the following insects: Peach twig borer and fruit worm (*Anarsia lineatella*); strawberry leaf roller (*Phoxopteris comptana*); oak carpenter worm (*Prionoxistus robiniæ*); green lice (*Hyalopterus pruni*), which seem to attack American varieties of fruit more than European and did a very considerable amount of damage during the year; black lice on plum and cherry; the apple aphis (*Aphis mali*); the elm aphis (*Schizoneura americana*), for which kerosene emulsion in ordinary strength and whale-oil soap in the proportion of 1 lb. to 8 gal. were found to be very effectual remedies; cottony maple scale (*Pulvinaria innumerabilis*), which affected very seriously the soft maples in Denver; harlequin cabbage bug (*Murgantia histrionica*), which was reported to the experiment station for the first time, specimens being sent from Kit Carson County, where the insect was said to be doing great harm; and the Mediterranean flour moth (*Ephestia kuehniella*).

An investigation of a case of what appeared to be bee paralysis is also briefly mentioned and attributed to the bees having eaten some fungus parasite of plants.

From the observations made by several persons it is thought that the first brood of the peach twig borer bores in the spring into tender shoots of peach, plum, apricot, and almond, and that the second brood bores into the fruit of the peach, while the third or fall brood bores into the crowns of strawberry plants. The oak carpenter worm has done considerable damage, but the only remedy thought worthy of suggestion is the plugging of the burrows of the insect with wooden plugs as soon as their castings indicate the presence of the worms.

Report of the entomologist, H. A. MORGAN (*Louisiana Stas. Bul. 48, 2. ser., pp. 128–159, pls. 5, figs. 18*).—The author reviews the legislation of the State relative to insects, and gives accounts of the following insects: The cotton mite, a new peach insect (*Artace punctistriga*), the fig borer (*Pitychodes trivittatus*), the harlequin bug (*Murgantia histrionica*), the peach and plum leaf sawfly (*Caliroa* [*Selandria*] *obsoletum*), pecan caterpillar (*Datana integerrima*), leaf footed bug (*Leptoglossus phyllopus*), a new insect attacking corn (*Delphax maidis*). An account is given of finding maggots in the human alimentary canal. The insect proved to be *Hermetia illicens*, which infests lettuce, and it is to the affected person's eating this that the peculiar occurrence is attributed. The maggot and adult are figured. In most cases a description is given of the insects, enemies mentioned, and their habits, and the proper remedies are noted.

The new peach insect was found late in October, 1894, upon peach trees, in the vicinity of Baton Rouge.

A brief account of insecticides and their preparation is given. At the end of the bulletin there is a list of parasites bred from the eggs, larva, and pupa of various insects.

The San José scale in Ohio, F. M. WEBSTER (*Ohio Sta. Bul. 81, pp. 177–212, figs. 13*).—The author discusses recent work with regard to the insect; relates how it came to be introduced into Ohio; discusses the nursery problem; gives a report of the National Convention held at Washington, D. C., March 5, 1897, for the purpose of considering the subject of quarantining the fungus and insect enemies of plants; discusses the distribution of the scale by infested fruit and otherwise, and the treatment of nursery stock, orchards, and grounds; and notes the natural enemies of the scale, the necessity for drastic measures of repression, the difficulty of detecting the scale, and the trees attacked.

Twenty-three different places in the State, located in twenty counties, are now known to be infested with the scale.

For preventing the spread of the insect through nursery stock, a system of annual inspection by entomologists, and legislation to prevent the transportation from one State to another of all nursery stock unless it be accompanied by an official certificate, are advocated. The problem of preventing the distribution by means of fruit, it is stated, may be solved in the orchards where the fruit is grown.

The treatment of nurseries and nursery stock may be by the hydrocyanic gas method, which may be used in the case of large trees should it seem profitable to do so. In the case of large trees the author seems to think it doubtful whether the scale can be exterminated where it has become permanently established without sacrificing the tree.

As to remedies the author thinks, all things considered, the best results have been obtained with whale-oil soap, used at the rate of 2 lbs. to a gallon of water. But good results have been obtained by cutting back trees and treating them with pure kerosene oil applied with a brush or as a spray. The kerosene should be of a high grade and should be applied in fair weather when it can evaporate quickly. Several experiments with the remedy are reported. In some cases injury was done and in one case the tree was probably killed.

In the author's opinion, as ordinarily applied the remedy can not be safely used on peach trees or on tender varieties of plums, but if applied lightly it can be used with entire safety on plums, pears, and apples, especially when the trees are cut back. The most satisfactory effect will be obtained if applied early in the fall or late in the spring, or at both times.

No hope whatever is held out for material aid from natural enemies, though the black lady beetle (*Pentilia misella*) and the twice-stabbed lady beetle (*Chilocorus bivulnerus*) are mentioned.

In discussing the subject of distribution it is shown that the pest may be carried to a considerable distance by birds, or the young scale may be carried on the bodies of ants, grasshoppers, or, in fact, any insect frequenting the branches of trees where the scales occur. The wind is also an important factor, for it has been noted that the scales have been scattered for a much greater distance from the trees on which they were introduced in the direction of the prevailing winds of the season.

It is stated that the insect most likely to be confused with the scale is the Putnam scale (*Aspidiotus ancylus*). According to the author's observations, the quince does not suffer as badly as other fruit, while the Early Richmond cherry seems proof against the scale and the mulberry is not attacked at all.

Notes on the treatment of the San José scale, with directions for winter work, W. B. ALWOOD (*Virginia Sta. Bul. 72, pp. 11*).—This bulletin is mostly made up from notes from a series of experiments on the use of washes, etc. The resin and the salt-sulphur-lime washes so successful on the Pacific coast were found to be of little value; nor were any of the lye, soap, or kerosene emulsion preparations entirely satisfactory. Kerosene of the 120° flash test, although it killed all the insects, was not satisfactory, inasmuch as it affected the trees. Where potash solutions were fairly successful they were used in very strong solutions. The soap solutions, even when very strong, it was found must be applied with a brush. In only one instance was eradication of the insect successful.

With regard to winter treatment, it is shown that it is necessary to remove the rough outer bark in the treatment of young orchards before spraying with the soap preparations. It is believed that pure kerosene may be used with safety on all hardy fruit trees in such orchards, but it is not well at present to recommend its use by untrained persons. In the treatment of old orchards the trunk and branches should be cleared, and in all cases except peach, cherry, and pear trees kerosene may be used if care be taken only to moisten the bark with it. A further caution is to use it on a bright warm day, when the plants are dry and when evaporation will take place quickly. For peach and cherry trees a soap wash is thought safest.

In the case of small fruits, shubbery, etc., where possible the entire top should be cut away and destroyed. If a wash be used it should be one made from a potash soap. If kerosene be used it should not be lower than 120° flash test, since low grades are more injurious than high ones. Inasmuch as 40 gal. of the oil will spray from 300 to 400 trees, according to size, this remedy is not thought expensive.

The scale has been found in Virginia upon the following plants: Apple, pear, peach, plum, cherry, apricot, quince, raspberry, currant, gooseberry, grape, strawberry, rose, linden, elm, Osage orange, golden willow, silver maple, mountain ash, and actinidia.

A fungus disease of the San José scale, P. H. Rolfs (*Florida Sta. Bul. 41, pp. 518–543, pls. 2*).—The value of fungus diseases in controlling insects is discussed, and the discovery, in May, 1896, of a fungus (*Sphærostilbe coccophila*) attacking the San José scale with deadly effect is reported. The decrease of the fluted scale in Florida (E. S. R., 9, p. 575) is attributed to the action of this fungus. Its attacks on various scale insects have been noted by a number of observers. T. D. A. Cockerell reports it from Jamaica as attacking *Aspidiotus articulatus*. It is a common disease of *Aspidiotus obscurus*, on which it was discovered by A. L. Quaintance in 1896. Since then it has been found in Florida at De Funiak, on the oak.

The disease was experimentally disseminated by twigs infested by diseased bugs. The spores were grown on bread; acid, neutral, and alkaline agar; gelatin, and sterilized potatoes. Trees were sprayed with water in which infected bread had been soaked. On trees thus sprayed the disease took hold and spread rapidly. Wrapping the sprayed parts of the trees with cloths was found to accelerate the process greatly.

The author describes the growth of the fungus, and states, among other things, that when grown in strong liquid medium the mycelium seems to have the power of inhibiting the growth of spores. In cell cultures a great many spores collect near the mycelium, but do not germinate. When removed by only the fraction of an inch, a great many of them germinate. When removed to the outer edge of the hanging drop, the normal proportions germinate.

The fungus appears to have great powers of adaptability as to medium, temperature, and moisture. Acid media, however, seem better suited to it than alkaline, and slightly acid bread best of all.

In conclusion, it is noted that the best time to apply the material is after sundown in moist weather. The spores grown on bread germinate in a few hours and must find a suitable medium or they will perish, while those produced in the orange-colored protuberance formed on the scale will live for several months in dry weather. The material can be produced in great quantities, and its application to insects by a spray is an easy matter. Another point in its favor is that it is more thorough than insecticides. It is probably best adapted to moist climates. As soon as the insects have been killed they and the fungus are washed from the tree by rains, leaving no signs behind them save where the scales have injured the tree.

Notes on some European hymenopterous parasites of the Hessian fly (Cecidomyia destructor) and other insects, W. H. Ashmead (*Psyche, 1897, No. 259, pp. 135–138*).—A description is given of new species of parasites received in a lot of parasites bred from

Cecidomyia destructor and *C. avenæ* by Dr. Paul Marchal, Government Entomologist of France. From *C. destructor* Marchal bred the following: *Bœotomus* (*Micromelus*) *rufomaculatus*, ♀; *B. coxalis*, n. sp., ♂ ♀; *Merisus destructor*, ♂ ♀; *Holcœus cecidomyiæ*, n. sp.; *Eupelmus atropurpureus* ♀ ♂; *Polygnotus* (*Platygaster*) *zosine*, ♂. A single male specimen of *Isosoma brevicorne* was found in the lot and Marchal reports *Oscinis pusillus* as occurring in oat stubble. The specimens of *Bœotomus coxalis* were found at Poitou and in various parts of Vendée in France. It was also bred by Marchal from *Cecidomyia* (*Oligastrophus*) *avenæ* infesting oats. According to Ashmead the species comes near *B.* (*Merisus*) *subapterus* of Riley, but it is readily distinguished from that form by the metallic coxæ, darker flagellum, the longer funicular joints, and by its broader and more depressed abdomen. From *Merisus microptera* Lind. it seems fairly distinct.

In the winged form the female has a length of 2 mm., is of a general bronzed green color, with purplish head and lower part of thorax. The palpi are white; the scape of the antennæ, except apically, and the legs, except the coxæ, are brownish yellow; while the knees, the tips of the tibia and the tarsi, except the last joint, are yellowish white. The flagellum is brown, subclavate, and pubescent. The male, or subapterous form, is usually 6 mm. in length. It is of the same general color as the female; the scape and pedicel are brownish yellow; the flagellum is filiform, dark brown, and clothed with a fine pubescence. The mandibles are quadridentate and ferruginous. The coxæ are metallic and the abdomen black, becoming brassy towards the base.

Holcœus cecidomyiæ is a somewhat larger insect; the thorax is olive green, the scape, trochanters, knees, tibia, and the tarsi, except the last joint, honey yellow. It was bred in June from the Hessian fly attacking wheat. According to Ashmead, it is closely related to *H. torymoides* of Thomson, but is readily distinguished from that form by the color of the female, the shorter abdomen, the relative length of the segments, and the flagellar joints. The male is very readily distinguished by the very long joints of the flagellum clothed with black instead of white pili.

From *Cecidomyia avenæ* Marchal bred *Bœotomus coxalis*, *Merisus destructor*, *Homoporus luniger*, *Eupelmus atropurpureus* (=*atrocœruleus* of Thomson), *E. degeeri*, *Trichacis* (*Platygaster*) *remulus*, *Polygnotus* (*Platygaster*) *minutus*, and *Anaphes pratensis* (an egg parasite). With them were found specimens of *Isosoma brevicorne* which is thought by Ashmead to be a gall maker on oats, since most of the specimens were bred from insects taken from oat stubble.

From *Cecidomyia tritici* a single species, *Merisus destructor*, was bred.

Preliminary studies of North American Gomphinæ, J. G. NEEDHAM (*Canad. Ent., 19 (1897), No. 8, pp. 181–186, pl. 1*).—The name Orcus is replaced by Arigomphus. Several new species are described.

The Acridian subfamily Mastacinæ in the United States, S. H. SCUDDER (*Psyche, 1898, No. 262, p. 179*).—Specimens representing a new generic type closely allied to Masynates of Karsch, but differing from it in having a more appressed head and less convex vertex and broadly convex and prominent fastigium, were found near Los Angeles, California. The name *Morsea californica* is given them. The body is cinereous with a broad black median stripe on the vertex and the upper half of the lateral lobes of the pronotum and on the abdomen. The length is only 9 mm.

Notes on some species of North American moths, W. BEUTENMÜLLER (*Bul. Amer. Mus. Nat. Hist., 9 (1897), pp. 209–212, fig. 1*).—The two new varieties, *Catocala faustina carlota* and *C. stretchii sierræ*, are described. The first is figured.

Notes on North American Sesiidæ, with descriptions of new species, W. BEUTENMÜLLER (*Bul. Amer. Mus. Nat. Hist., 9 (1897), pp. 213–216*).—The new variety, *Sciapteron dollii carlota*, and the new species, *Sesia sigmoidea*, *S. ithacæ*, and *Zenodoxus mexicanus*, are described. The first new species was found at Walpole, Massachusetts, the second at Ithaca, New York.

Diptera of the Mesilla valley of the Rio Grande in New Mexico, I, C. H. T. TOWNSEND (*Psyche, 1897, No. 260, pp. 147–150*).—Tabanidæ, Syrphidæ, Conopidæ, Gymnosomatidæ, Ocypteridæ, and Tachinidæ *sensu stricto*.

The Coleoptera of Canada, XXVI. The Cerambycidæ of Ontario and Quebec, H. F. WICKHAM (*Canad. Ent., 29 (1897), No. 8, pp. 187–193, figs. 2*).

Contributions to experimental lepidopterology, II, E. FISCHER (*Illus. Wchnschr. Ent., 2 (1897), No. 37, pp. 577–583, figs. 8*).—Experiments with *Vanessa urticæ* and *V. aberratio ichnusoides* with low temperatures, demonstrating that cold may cause development to take a different direction from the normal.

Contributions to experimental lepidopterology, III, E. FISCHER (*Illus. Wchnschr. Ent., 2 (1897), No. 38, pp. 595–600, figs. 6*).—Experiments with *Vanessa polychlorus* and *V. aberratio testudo*.

A new Lecanium on magnolia from Florida, T. D. A. COCKERELL (*Psyche, 1897, No. 260, p. 152*).—*Lecanium turgidum*, common on *Magnolia glauca* and *M. grandiflora* at Lake City, Florida. The young appear in rather large numbers in April, and apparently during the year finish their life cycle.

A new ant nest coccid, G. B. KING and T. D. TINSLEY (*Psyche, 1897, No. 260, pp. 150, 151, figs. 2*).—*Dactylopius claviger*, n. sp., is noted.

On a new species of Forficularia, M. BURR (*Ann. Mag. Nat. Hist., 6. ser., 20 (1897), No. 117, pp. 310–316*).

Some further remarks on Otiorhynchus ligustici, M. HOLLRUNG (*Illus. Wchnschr. Ent., 2 (1897), No. 35, pp. 549, 550*).—The insect is said to be subject to the attacks of a species of Botrytis. Various remedial measures suggested are Anttinonnin, Schweinfürter green, dilute carbon bisulphid, and alcoholic soap solution. The first generation of the insect appears as early as the end of February. Pupæ have been found in the middle of July. Larval development is slow.

Synonymical and critical observations on Tenthridinid species hitherto not or incorrectly so called, W. KONOW (*Illus. Wchnschr. Ent., 2 (1897), Nos. 16, pp. 250–254; 17, pp. 267–269; 18, pp. 281–284; 19, pp. 296–298; 20, pp. 314–320*).

Notes on the Lerp insect (Psyllidæ) of Australia, E. A. SCHWARZ (*Proc. Ent. Soc. Washington, 4, No. 2, pp. 66–75*).—A new genus and species, *Cardiaspis artifex*, is described.

The compound eye of the Ephemeridæ, C. ZIMMER (*Ztschr. Wiss. Zool., 63 (1897,) pp. 236–262, pls. 2; abs. in Zool. Centbl., 5 (1898), No. 3, pp. 87–89*).

The intestinal canal of the larva of Arthrenus, with remarks on the regeneration of its epithelium, A. MÖBUSZ (*Arch. Naturgesch., 63 (1897), No. 2, pp. 89–128, pls. 3; abs. in Zool. Centbl., 5 (1897), No. 3, pp. 89–91*).

On a peculiar organ of the bedbug, C. RIBAGA (*Riv. Path. Veg. 5, No. 9–12, pp. 343–353, figs. 4; pl. 1*).—A microscopic study of what is believed to be a stridulating organ situated in the hinder margin of the right side of the ventral part of the fourth abdominal ring of the bedbug (*Cimex lectularius*) is reported.

On the white Eucleidæ and the larva of Calybia slossoniæ, H. G. DYAR (*Jour. New York Ent. Soc., 5 (1897), No. 3, pp. 121–126, pl. 1*).—The 5 species of Calybia noted are distinguished as follows: *C. immaculata* by the inside of the primaries being entirely white; in all the others this side is partly gray, especially along the costa. *C. slossoniæ* is to be distinguished by the primaries being white above and by a yellowish spot near the angle in the male. *C. pigmæa* has white primaries and shows a distinct zigzag yellowish brown mark above the anal angle. *C. fumosa* instead of entirely white has a subterminal smoky band on the primaries, and in *C. jamaicensis* the secondaries are gray above instead of white, as in the last 3 forms. The two species, *Leucophobetron argentiflua* and *L. agyrorrhœa*, are distinguished by a large dark spot above the anal angle of the wings of the former species and by the wings being immaculate white in the latter.

On the habits of Coccinella 7-punctata, K. SAJO (*Illus. Wchnschr. Ent., 2 (1897), No. 34, pp. 529, 530*).—Cannibalistic habits are noted, also that the larva feeds on *Cochylis ambiguella* and in all probability on *Lema melanopsus*.

The cases of the German Phryganids, RUDOW (*Illus. Wchnschr. Ent., 2 (1897), No. 29, pp. 451–456, figs. 26*).

The enemies of the butterflies, A. PREHN (*Illus. Wchnschr. Ent., 2 (1897), No. 30, pp. 465–469*).

On the post alar membrane of Diptera, E. GIRSCHNER (*Illus. Wchnschr. Ent., 2 (1897), Nos. 34, pp. 534–539, figs. 8; 35, pp. 553–559, figs. 5; 36, pp. 567–571, figs. 7; 37, pp. 586–589; 38, pp. 603–607, figs. 2; 41, pp. 641–645, figs. 23*).

Nocturnal larva hunting, SCHENKLING-PRÉVÔT (*Illus. Wchnschr. Ent., 2 (1897), Nos. 31, pp. 487–492; 32, pp. 502–505*).—Mostly short descriptions of larvæ to be found during the several spring and summer months.

A curious case of protective coloration, T. D. A. COCKERELL (*Psyche (1897), No. 260, p. 154*).—The pupæ of *Pyrameis cardui* are so colored as to be hidden in blossoms of *Baileya multiradiata*. The larvæ feed only on *Solanum elæagnifolium* and seem to warder to the blossoms of the other plant to pupate.

A principle to observe in naming galls. Two new gall-making diptera, W. H. PATTON (*Canad. Ent., 29 (1897), No. 10, pp. 247, 248*).—The principle consists in writing the name of the genus of the host plant with the name of the genus of the gall makers, connecting the two with a hyphen. Applying the principle the author changes the names of the galls described in the Fifth Report of the United States Entomological Commission to *Cecidomyia-celtis oviformis, C. semenoumicis, C. pubescens, C. capsularis,* and *C. spiniformis.* The new species are *Œdaspis-solidago atra,* the galls of which do not differ from those of *Œ. polita,* and *Cecidomyia-celtis* (new genus) *deserta.* The galls of the latter are hollow elongate swellings of young twigs from which the flies emerge about the first of June.

Gall wasps of oaks, C. KELLER (*Jour. Suisse Econ. Forest., 1896, No. 2*).

Chinese insect white wax, G. F. SMITHERS (*U. S. Consular Rpts., 1897, No. 203, pp. 484–490*).—The best of the insects (*Coccus pe-la*) that produce white wax are found in the Chien-Ch'ang Valley. Those from elsewhere bring a lower price, where they are found on the evergreen, *Ligustrum lucidum,* which has various local names, as ch'ung shu, or insect tree; tung ching shu, or evergreen tree; and pao-kê-ts'ao shu, or crackling flea tree. The insects from Chien-Ch'ang Valley, found for the most part near the town of Tê Chang on the Au-ning River (latitude 27° 24′), are transported to the plain north of the Ta-tu River north of Chien Ch'ang, where they are placed on the wax tree, *Fraxinus chinensis,* known to the Chinese as the pai la shu. One pound of the scales produces 4 to 5 lbs. of wax. The process of obtaining the wax is described.

Renewing of queens, DEVAUCHELLE (*L'Apiculteur, 42 (1898), No. 1, pp. 14–17*).—The author's practice is to destroy few queens, and only those manifestly poor layers or otherwise bad. It is not necessary to renew them every three years.

Humidity of hives during winter (*L'Apiculteur, 41 (1897), No. 11, pp. 444–454*).—A critical summary of the ideas of various authors on the subject.

A garden pest, Creoceris lilii Scop. (merdigera F.), C. SCHRÖDER (*Illus. Wchnschr. Ent., 2 (1897), No. 33, pp. 516–518, figs. 4*).—The eggs are laid about the first of May and hatch about fourteen days later. The larvæ attack the leaves of *Fritillaria imperialis,* eating the upper surface and the parenchymatous tissue below it to the epidermis of the under side. The latter and the veins are left untouched. Finally they eat away the leaf at its edge. Since full-grown insects and larvæ are found at the same time on the food plant it is probable that there are several broods a year. According to Bos the winter is passed in the pupal state, but the author is inclined to think that the fertilized female lives through the winter. When the beetles occur in large numbers they do a very considerable amount of damage.

Notes on scale insects, II, T. D. A. COCKERELL (*California Fruit Grower, 20 (1897), No. 23, pp. 4, 5*).—The following new species appear, along with brief descriptive notes: *Aspidiotus andromalas, A. crawii, A. greenii, Chionaspis latissimus, Dactylopius edgeworthiæ, Mytilaspis pallida maskelli,* and *Parlatoria theæ euonymi.*

Otiorhynchus ligustici, H. GAUCKLER (*Illus. Wchnschr. Ent., 2 (1897), No. 33, pp. 524, 525*).—The proper food plant of this wingless beetle appears to be alfalfa, though its larva does not dislike the peach and the grape. It often attacks the roots of the latter and does great damage. The beetles eat mostly at night and consequently are found in small numbers during the day.

Our Blissus doriæ, K. SAJO (*Illus. Wchnschr. Ent., 2 (1897), No. 29, pp. 449–451*).—This species is compared with its American relative, *B. leucopterus.* It does not go into cultivated fields and is not so easily affected by *Sporotrichum globuliferum.*

A concealed enemy of the raspberry, G. MÜLLER (*Illus. Wchnschr. Ent., 2 (1897), No. 30, pp. 469–471, figs. 8*).—A portion of the life history and the habits of *Bembecia hylæformis* are described. The insect sometimes attacks the cultivated raspberry. The larva is found in the interior of the young shoots, seldom in those of the previous year's growth—almost always with the head directed upward. The author states that the moth is not exclusively nocturnal, and that there are two broods a year. A number of braconid and ichneumon parasites of the insect are known. *Meniscus pimplator* and *Bracon regularis* are mentioned.

Insect enemies of potatoes, I. P. ROBERTS and L. A. CLINTON (*New York Cornell Sta. Bul. 140, pp. 391, 392*).—Brief notes are given on the leaf flea beetle and Colorado potato beetle, with suggestions for their destruction.

The use of arsenites on tobacco, H. GARMAN (*Kentucky Sta. Rpt. 1896, pp. 69–80, pls. 2*).—A reprint from Bulletin 63 of the station (E. S. R., 8, p. 319).

Triconympha and other parasites of Termes flavipes, J. P. PORTER (*Bul. Mus. Comp. Zool., 31 (1897), No. 3, pp. 47–67, pls. 6*).—This deals with *Trichonympha agilis, Pyrsonympha vertens, Dinenympha gracilis,* and Gregarinida—protozoan parasites.

The large libellulids considered as useful animals destroying noxious insects, R. MARTIN (*Excerpt from Bul. Soc. Nat. Acclim. France, 1897, pp. 4*).

Report of the entomologist, H. GARMAN (*Kentucky Sta. Rpt. 1896, pp. XXIV–XXVIII, figs. 3*).—The author notes that complaint of insect depredations in Kentucky were more than usually frequent during 1896. Requests were received for the parasite fungus for the destruction of chinch bugs from thirteen different counties. The objection to the use of the fungus that the bugs are slowly affected by it is noted, but it is thought this defect may be overcome to a certain extent by sending larger packages. The army worm is mentioned as doing considerable injury.

Analyses of Paris green, W. C. STUBBS (*Louisiana Stas. Bul. 49, 2. ser., pp. 198–204*).—The text of the State law relating to Paris green is given, the use of Paris green in Louisiana is discussed, and analyses of thirty-nine samples are reported. The samples of Paris green sold on our market show, as a rule, high percentages of arsenious acid (white arsenic), all but one being well above the requirements.

FOODS—ANIMAL PRODUCTION.

A digest of metabolism experiments in which the balance of income and outgo was determined, W. O. ATWATER and C. F. LANGWORTHY (*U. S. Dept. Agr., Office of Experiment Stations Bul. 45, pp. 433*).—In view of the fact that some of the experiment stations are carrying on metabolism experiments, the attempt was made to gather as many as possible of such experiments made in the United States and other countries up to 1895 with man and animals in which the balance of income and outgo of matter and energy was determined. The balance of matter is usually expressed in terms of nitrogen, with or without mineral matter; or nitrogen and carbon, with or without mineral matter, oxygen or hydrogen. The balance of energy is expressed in terms of heat. Over 3,600 individual tests or averages are included in the compilation. Of these about 2,300 were made with man, about 400 with cattle and horses, 950 with sheep, dogs, and other domestic quadrupeds, and 51 with poultry and doves. In about 3,400 experiments the balance of nitrogen and in about 300 the balance of carbon was determined.

The experiments with men, women, and children included in the compilation were made under various conditions of health and disease. Those with animals were usually made under normal conditions for the study of various economic problems, although some were made under other conditions for special purposes. In compiling the results the date and original source of publication of the investigation, the observer, the subject with age and weight, food consumed, duration of experiment, and the nitrogen (or nitrogen and carbon with or without other elements) in the food and excretory products are included in tables. In text accompanying the tables the experiments are described, the methods followed are given, and the deductions drawn from the experiments are cited.

The experiments with man in which the nitrogen balance was determined are arranged in three general groups—(1) healthy subjects, influence of diet; (2) healthy subjects, influence of other conditions than diet; and (3) diseased subjects. The first group includes experiments with a vegetarian diet, milk diet, bread and other single-food materials, alcoholic beverages, kephir, koumiss, peptones, and similar preparations, to determine the amount of protein required, and miscellaneous. The second group includes experiments with fasting subjects, drugs, and on the influence of muscular exertion, massage and faradization, baths and enemas, pregnancy, childbirth, menstruation, copious and diminished water drinking, and compressed air. The third group includes specific infectious and constitutional diseases and diseases of the digestive system, respiratory system, circulatory system, blood and ductless glands, kidneys, nervous system, and bones. The experiments with man in which the income and outgo of carbon was determined, *i. e.*, respiration experiments, form a group by themselves and are not subdivided. The experiments in which the nitrogen balance was determined with cattle, dogs, doves and poultry, goats, horses, rabbits, sheep, and swine constitute separate groups. The experiments with animals in which the income and outgo of carbon was determined form a group by themselves, as do also the experiments with animals in which the income and outgo of energy was determined.

The purpose of the compilation is primarily to give a brief epitome, so far as practicable, of the objects and results of individual tests. The tables furnish the framework of such epitome, while supplementary matter is given in the accompanying text.

The bulletin includes an introductory chapter giving historical information concerning the subject, explaining the scope and plan of the compilation, and calling attention to some of the points to be considered in drawing deductions from the experiments. A name and subject index is appended.

Dietary studies in New York City, W. O. ATWATER and C. D. WOODS (*U. S. Dept. Agr., Office of Experiment Stations, Bul. 46, pp. 117*).—Twenty-two dietary studies of families living in a congested portion of New York City are reported, together with studies at a mission and a day nursery in the same region. The methods followed in making the investigation were practically the same as those described in Bulletin 21 of this Office. The families were selected as typical of the so-called poor classes usually encountered by philanthropists and mission workers in the congested districts of large cities.

Tables are given showing the kind and amount of food purchased, wasted, and eaten, and its cost, composition, and fuel value. The more technical details of the studies are included in an appendix. The results of the studies are briefly summarized as follows:

Results of dietary studies—cost and composition of food eaten per man per day.

	Cost.	Protein.	Fat.	Carbohydrates.	Fuel value.
	Cents.	*Grams.*	*Grams.*	*Grams.*	*Calories.*
Mechanic's family	31	149	128	526	3,955
Carpenter's family	23	148	144	458	3,825
Jeweler's family	18	99	104	296	2,595
Sailor's family	26	139	143	558	4,170
Watchman's family	13	84	92	292	2,400
Carpet dyer's family	16	71	93	310	2,430
Family of carver in a restaurant	13	85	88	261	2,235
Sailors' boarding house	17	95	125	181	2,295
Truckman's family	22	100	129	325	2,935
Sewing woman's family	9	54	41	219	1,500
Shopkeeper's family	15	80	109	351	2,780
Housekeeper's (widow) family	18	93	104	509	3,435
Laborer's family	23	139	119	345	3,090
Porter's family	28	142	142	444	3,720
Printer's family	22	116	124	364	3,120
Truckman's family	22	136	135	595	4,250
Family of caretaker at a day nursery	23	122	158	394	3,585
Builder's family	41	187	219	723	5,770
Do	42	204	264	714	6,220
Salesman's family	16	79	125	347	2,910
Tin roofer's family	20	99	123	327	2,910
Do	16	84	114	227	2,335
Family at a mission	37	143	205	545	4,725
Children at a day nursery (per child per day)	4	30	20	120	800

From the data available the authors do not feel warranted in drawing specific deductions. Some general suggestions for the improvement of the dietaries are, however, made. By the selection of cheaper, though equally nutritious, articles of food it would as a rule have been possible to supply a more nutritious diet at less cost. In many instances, while the foods chosen were inexpensive, they were of such a character that they contained a small percentage of nutrients. Purchasing in quantity, where possible, would also have diminished the cost. Some of the families studied had a sufficient income to enable them to live comfortably if care had been exercised in its expenditure. The authors believe that permanent improvement must come through education. The people must be taught to select food wisely and to cook it and serve it in an acceptable manner.

Report on the dietaries in nine institutions of the city of Boston, ELLEN H. RICHARDS and SARAH E. WENTWORTH (*Institutions Commr., Boston, Rpt. 1896, pp. 206–219*).—On the basis of raw materials furnished and number of persons fed the dietaries of the inmates of a number of houses of correction and other institutions in the city of Boston were calculated. The results are briefly summarized in the following table:

Calculated amount and cost of nutrients consumed per person daily.

	Number of persons fed.	Cost.	Protein.	Fat.	Carbohydrates.	Fuel value.
		Cents.	*Grams.*	*Grams.*	*Grams.*	*Calories.*
South Boston House of Correction	523	9.89	153	78	501	3,406
Deer Island House of Correction	1,754	7.34	122	69	624	3,700
Rainsford Island House of Reformation	125	8.07	103	60	414	2,677
Parental School	125	5.29	70	40	346	2,078
Marcella Street Home	333	8.37	95	55	380	2,459
Long Island Almshouse and Hospital	833	7.73	109	48	554	3,164
Charlestown Almshouse and Hospital	145	7.54	71	72	355	2,415
Austin Farm (inmates and employees)	375	12.94	110	114	449	3,327
Pierce Farm (inmates and employees)	194	18.85	138	180	471	4,171

The amounts of food eaten by the officers in a number of these institutions are also recorded, though the composition of the diet is not calculated. The dietaries are discussed at some length and compared with the commonly accepted dietary standards. Improvements are suggested.

Experiments in fattening sheep, J. GRUDE (*Aarsber. Offent. Foranst. Landbr. Fremme, 1896, pp. 277–289*).—In continuation of work previously reported (E. S. R., 5, p. 919; 8, p. 154), the agricultural society of Stavanger County, Norway, conducted experiments with sheep. Two hundred and sixty sheep were used in all, divided into lots of 10 each. The actual feeding was carried on according to directions furnished by the society on 13 different farms, with 2 lots at each place. Of the total number of animals 50 were wethers 1½ years old, 80 wethers 2½ years old, 50 ewes 1½ years old, 40 ewes 2½ years old, and 40 breeding ewes 4 to 7 years old. The following table shows the average results of the feeding trials:

Results of sheep-fattening experiments, 1896.

	Number of animals.	Age of animals.	Average length of fattening period.	Feed per day per 1,000 kg. live weight.				Weight at beginning.	Weight at end.	Increase.
				Hay.	Turnips.	Linseed oil cake.	Oats.			
		Years.	*Days.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Per cent.*
Wethers	50	$1\frac{1}{2}$	50.2	4.5	75.0	16.6	3.6	44.3	55.5	25.3
Do	[1]79	$2\frac{1}{2}$	51.8	5.1	69.7	15.1	3.9	51.3	63.4	23.5
Ewes	50	$1\frac{1}{2}$	51.0	6.5	69.5	16.6	3.9	43.0	53.0	23.4
Do	40	$2\frac{1}{2}$	51.8	5.5	80.3	15.4	4.4	45.7	56.6	23.9
Breeding ewes	40	4–7	65.8	5.1	68.4	15.8	4.1	46.3	57.5	24.4
Totals and averages	259	....	53.3	5.3	71.7	15.7	4.0	46.9	57.9	24.0

[1] One animal died in the early part of the experiment.

The following conclusions were reached: The fattening period should not extend beyond 40 days. Full value may be obtained for home farm products by fattening sheep under conditions similar to those here reported.—F. W. WOLL.

Feeding experiments with chicks and capons, W. P. WHEELER (*New York State Sta. Bul. 126, pp. 307–325, pl. 1, figs. 2*).—Tests were made with chickens and capons to compare the value of whole and ground grains as commonly fed. The principal test was begun with 2 lots of 22 chickens each. Lot 1 was fed finely ground grain, the basis of the ration being a mixture of corn meal, wheat bran, wheat middlings, old-process linseed meal, and oats, 2:2:1:1:1. This was supplemented by skim milk, dried blood, and additional amounts of corn meal and ground oats. Lot 2 was fed either whole or cracked oats, wheat, corn, and barley. In addition some skim milk, fresh-cut bone, and dried blood were fed. The average nutritive ratio for lot 1 was 1:3.3, and for lot 2, 1:4.6.

The composition of the food is reported.

The chickens were hatched in incubators and kept in outdoor lamp brooders surrounded by a small grass run. The test began as soon as the chickens were hatched and covered 92 days. During the whole period both lots made satisfactory growth and remained healthy. Lot 1 consumed 4.56 lbs. and lot 2 4.4 lbs. of dry matter per pound of gain. The cost of food per pound of gain for the 2 lots was 3.33 cts. and 3.76 cts., respectively If heating the brooders is taken into account also the cost was 3.98 cts. and 4.5 cts. At the end of 12 weeks the average weight of the chickens in lot 1 was 2.9 lbs.; in lot 2, 2.6 lbs., and the average cost per chicken 15.3 cts. and 15 cts., respectively.

The time required to reach 1 lb. weight by lot 1 was 6 weeks, and by lot 2, 7 weeks; the time required to reach 2 lbs. weight was 10 weeks and $10\frac{1}{2}$ weeks, respectively. The cost for the 2 lots of food per chicken to weight of 1 lb. was 3 cts. and 3.7 cts.; to weight of 1.5 lbs., 4.9 cts.

and 5.8 cts.; to weight of 2 lbs., 7.2 cts. and 7.3 cts.; to weight of 2.5 lbs., 8.6 cts. and 9 cts.

At the end of 3 months the 12 roosters in lot 1 and the 7 in lot 2 were caponized and were fed for about 7 months a fattening ration consisting of corn meal, wheat bran, wheat middlings, ground oats, and ground barley, 10:2:1:1:1, with the same supplementary foods as were fed previously. The grains fed to lot 1 were ground and to lot 2 unground. During the first 4 months lot 1 consumed 6.5 lbs. dry matter (costing 7.2 cts.) per pound of gain; and lot 2 consumed 6 lbs. dry matter (costing 6.9 cts.). In 6 months lot 1 consumed 8.6 lbs. dry matter (costing 8.6 cts.) per pound of gain; and lot 2 consumed 7.45 lbs. dry matter (costing 8.3 cts. per pound).

"Considering the total cost of food from hatching, the average bird receiving the ground grain had cost 35.5 cts. at 5 months of age, and weighed 8.1 lbs., thus costing 4.38 cts. per pound. Those fed whole grain weighed 7.5 lbs. and had cost 34 cts., or 4.53 cts. per pound. At 6½ months lot 1 had cost 5.4 cts. a pound for an average weight of 10 lbs., and lot 2, 5.49 cts. per pound for a weight of 9.5 lbs."

A second trial was begun October 31 with 2 lots of 12 capons under conditions similar to those previously described, and covered about 5 months. Four capons in each lot were dropped several weeks before the close of the test. During the entire period the lot on ground grain consumed 8.3 lbs. dry matter per pound of gain; the lot on whole grain 10.1 lbs. Profitable gains were made only during the first 11 weeks of the test, when the lot on ground grain consumed on an average 6.8 lbs. dry matter (costing 7.2 cts.) per pound of gain, and the lot on ground grain consumed 6.9 lbs. (costing 7.8 cts.). After this time the gains were very slow and about equal for both lots.

From the experiments as a whole the following conclusions were drawn:

"A ration consisting mostly of the ordinary ground grains was more profitably fed to chicks than a ration of whole grain.

"Capons from lot 2 afterwards made a somewhat cheaper gain in weight on the whole grain ration, but the gain was too slow to compensate for the more rapid growth which had been made, as chicks, by lot 1 on ground grain.

"Of two other lots of capons those having the ground-grain ration made the more profitable gain during several months.

"In every trial more food was eaten by the lots on the ground grain than by the lots on whole grain."

None of the chickens or capons showed any lack of health and vigor.

Italian paste made from wheat, corn, and a mixture of the two, A. Scala (*Bol. Not. Agr., 19 (1897), II, No. 27, pp. 355–364*).—The author reports the composition of macaroni, vermicelli, and other forms of Italian paste made from wheat, corn, and a mixture of the two. The composition of pastes and bread is compared with that of the flour from which they are made.

The adulteration of Italian paste with corn meal and corn pastes, A. Scala (*Bol. Not. Agr , 19 (1897), II, No. 27, pp. 351–354*).—The author points out the difference in precentage composition between Italian paste made from wheat alone and that from wheat with the addition of corn. On the basis of variation in composition a method of detecting adulteration is suggested.

The adulteration of Italian paste with corn meal and corn pastes, A. SCALA (*Ann. Ig. Sper., n. ser., 6 (1896), No. 3, pp. 409–423*).—The author discusses Italian paste made from wheat, alone and mixed with corn.

Maize diet and a way of improving it, A. CELLI (*Bol. Not. Agr., 19 (1897), II, No. 27, pp. 343–350*).—The importance of maize as a food is insisted upon. Polenta and Italian paste made from corn, corn and wheat, and wheat alone are compared on the basis of their composition, cost, and digestibility.

Semolina and Italian pastes, BALLAND (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 8, pp. 605, 606*).—Analyses of macaroni and other Italian pastes, semolinas, and tapioca.

Cocoa as a food, BEDDIES and TISCHER (*Ueber Kakao-Ernährung. Berlin, 1897; rev. in Hyg. Rundschau., 8 (1898), No. 4, p. 211*).—The authors made a comparative study of a number of cocoa preparations. Digestion experiments are reported of cocoa alone and in combination with other foods.

Lily bulbs and flowers as food, J. B. DAVY (*Erythea, 6 (1898), No. 3, p. 26*).—The bulbs of *Lilium japonicum brownii*, *L. cordifolium*, *L. tigrinum*, *L. concolor pulchellum*, and *L. glehni*, and the dried flowers of *L. bulbiferum* and *Hemerocallis graminea*, are used as food by the Chinese and Japanese.

The nutritive value of certain patented substitutes for milk, G. B. SOMONCINI (*Ann. Ig. Sper., n. ser., 7 (1897), No. 1, pp. 99–102*).—The author reports the nitrogen content and digestibility (obtained by digestion with pepsin and hydrochloric acid) of "milk flour" and "chocolate milk."

Determining the source of different cuts of meat, OSTERTAG (*Ztschr. Fleisch u. Milchhyg., 8 (1898), No. 6, pp. 101, 102*).

The use of beef infested with tænia, ZSCHOCKE (*Deut. Tierärzl Wchnbl., 1897, No. 52, p. 458*).

Black pepper from Mangelore, T. F. HANAUSEK (*Ztschr. Untersuch. Nahr. u. Genussmtl., 1898, No. 3, pp. 154–156, figs. 4*).

Adulteration of buckwheat flour sold in the Lawrence market, M. A. BARBER (*Kansas Univ. Quart., 7 (1898), No. 1, pp. 37, 38, pls. 2*).—A number of samples purchased as pure were examined microscopically. Several were found to be adulterated with wheat starch.

Seventh report on the health and sanitary condition of the cities of Berlin and Charlottenburg during the years 1892, 1893, and 1894, A. WERNICH and SPRINGFELD (*Siebenter Gesammtbericht über das Sanitäts und Medicinalwesen in den Städten Berlin und Charlottenburg während der Jahre 1892, 1893, 1894. Berlin: R. Schoetz; rev. in Hyg. Rundschau., 8 (1898), No. 4, pp. 212, 213*).—In addition to other matter, this volume contains a report on the inspection of food.

Workrooms in bakeries, A. MISCHA (*Monatsschr. Gesundheitspfl., 15 (1897); abs. in Hyg. Rundschau., 8 (1898), No. 5, pp. 251, 252*).—The need of clean bakeries is insisted upon. Some of the defects of German bakeries are pointed out.

The dietaries of the students of the University of Padua, A. SERAFINA and F. ZAGATO (*Bol. Not. Agr., 19 (1897), I, No. 2, pp. 167–201, tables 5*).—See abstract from a German publication of this article (E. S. R., 9, p. 265).

Carob bean as a feeding stuff, F. TUCCI (*Bol. Not. Agr., 19 (1897), II, No. 19, pp. 86–91*).—New analyses of carob bean or St. John's bread (*Ceratomia siliqua*) and experiments in feeding it to milch cows are reported, and the importance of the carob bean as a feeding stuff is insisted upon.

Observations and experiments on the nutritive value of carob bean, S. BALDASSARE (*Bol. Not. Agr., 19 (1897), I, No. 2, pp. 29–48*).—The composition and digestibility of carob bean or St. John's bread is discussed, rations of it are suggested for horses, and feeding experiments with milch cows are reported. In the author's opinion the carob bean is especially valuable food for dairy cows.

Grapevine foliage as a feeding stuff, F. TUCCI (*Bol. Not. Agr., 19 (1897), II, No. 18, pp. 64–69*).—The author points out the value of grape leaves as a feeding stuff.

Possible feeding stuffs for the arid regions of Sicily or for use when fodder is scarce, F. Tucci (*Bol. Not. Agr., 19 (1897), I, No. 2, pp. 62–85*).—The feeding stuffs discussed include the joints of prickly pear, forage beets, prickly comfrey (*Symphytum asperrinum*), and the leaves of mulberry, poplar, *Ficus beniamina*, and *Ligustrum lucidum*. Proper feeding stuffs in various combinations for different seasons of the year are suggested.

The cotton-seed meal on the market, Dietrich (*Deut. Landw. Presse, 25 (1898), No. 13, pp. 133–135*).—A general article comparing American and German cotton-seed meal.

The use of meat meal as a feeding stuff, S. Baldassare (*Bol. Not. Agr., 19 (1897), I, No. 2, pp. 49–61*).—Experiments are reported on the use of meat meal for calves.

Physiology of digestion, H. Vigoroux (*Jour. Hyg., 23 (1898), Nos. 1119, pp. 100–103; 1121, pp. 125, 126*).—A brief discusssion of digestion, assimilation, balance of income and outgo, etc.

The influence of the pancreas on the assimilation of food, S. Rosenberg (*Arch. Physiol. [Pflüger], 67, No. 9–10, pp. 371–449*).—A number of experiments with dogs are reported.

The function of pancreatic juice and of bile in the resorption of fat, E. Hédon (*Arch. Physiol. Norm. et Path., 5. ser., 9 (1897), pp. 622–634*).

On the digestibility and absorption of fat when a biliary fistula is made and the pancreas removed, E. Hédon and J. Ville (*Arch. Physiol. Norm. et Path., 5. ser., 9 (1897), pp. 606–621*).

Changes in the form and position of the stomach of man during digestion, A. Bianchi and C. Comte (*Arch. Physiol. Norm. et Path., 5. ser., 9 (1897), pp. 891–904*).

Absorption in the small intestine, I, R. Höber (*Arch. Physiol. [Pflüger], 70, No. 11–12, pp. 624–642*).—Experiments were made with dogs and rabbits on the absorption of solutions of a number of salts.

The action of blood serum and a solution of propeptone on certain digestive ferments, L. Camus and E. Gley (*Arch. Physiol. Norm. et Path., 5. ser., 9 (1897), pp. 764–776*).

Experimental and critical studies of the feces of infants fed cow's milk and woman's milk, M. Blauberg (*Experimentelle und kritische Studien über Säuglengsfäces bei naturlicher und künstlicher Enährung. Berlin, 1897; abs. in Hyg. Rundschau., 8 (1898), No. 4, pp. 210, 211*).

On excessive nutrition, G. Pecori (*Ann. Ig. Sper., n. ser., 6 (1896), No. 4, pp. 483–565*).—A number of experiments with men on a mixed diet are reported, in which the food, urine, and feces were analyzed.

Researches on organic phosphorus, L. Jolly (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 7, pp. 531–533*).—The author reports investigations which lead to the conclusion that unoxidized phosphorus does not exist in tissue.

The value of asparagin for Herbivora, O. Kellner (*Chem. Ztg., 21 (1897), No. 80, pp. 820, 821*).—The author briefly reports results of a number of experiments conducted by Redner with lambs to determine the value of asparagin. Fifty grams of asparagin was substituted for 50 gm. of starch in wide and narrow rations. An experiment was also made in which 50 gm. of ammonium acetate was substituted for the same quantity of starch. The balance of income and outgo of nitrogen, and in some cases of sulphur, was determined. When asparagin and ammonium acetate were consumed the daily gain of nitrogen was larger than when this was not the case; that is, both substances served to protect protein. It was believed that this action was due to the fact that asparagin and ammonium acetate served as nitrogenous nutrients for the intestinal bacteria and so prevented the destruction of protein in the intestinal tract.

The gaseous exchange and expenditure of energy of a bicycle rider, L. Zuntz (*Arch. Physiol. [Pflüger], 70, No. 7–8, pp. 346–348*).—A brief account is given of the author's experiments.

A critique of Hirn's experiments on thermodynamics and work of the living organism, A. CHAUVEAU (*Arch. Physiol. Norm. et Path., 5. ser., 9 (1897), pp. 229–238*).

The laws of working muscles during voluntary contraction, as shown by a study of the respiratory quotient, J. TISSOT (*Arch. Physiol. Norm. et Path., 5. ser., 9 (1897), pp. 78–89, figs. 2*).

Experimental studies on elasticity and the energy produced in muscles during voluntary contraction, J. TISSOT (*Arch. Physiol. Norm. et Path., 5. ser., 9 (1897), pp. 90–95*).

Experiments on the law of the consumption of oxygen and the formation of carbon dioxid in the organism, C. BOHR and V. HENRIQUES (*Arch. Physiol. Norm. et Path., 5. ser., 9 (1897), pp. 459–474*).

Critical observations on C. Bohr and V. Henriques's determination of the law of the consumption of oxygen and the formation of carbon dioxid (*Arch. Physiol. Norm. et Path., 5. ser., 9 (1897), pp. 710–713*).

Experimental studies on the production of carbon dioxid and the consumption of oxygen in the lungs (pulmonary combustion), C. BOHR and V. HENRIQUES (*Arch. Physiol. Norm. et Path., 5. ser., 9 (1897), pp. 590–605, fig. 1*).

On the physiological effects of covering the skin with varnish and the cause of death following this procedure, F. LAULANIE (*Arch. Physiol. Norm. et Path., 5. ser., 9 (1897), pp. 302–316*).—Experiments were made with rabbits and a dog. The changes produced in the production of heat and on nutrition of the animals when the skin was varnished were studied. The respiratory quotient was determined.

Variations in the cooling power of water in terms of temperature and time. Studies with man, J. LEFÈVRE (*Arch. Physiol. Norm. et Path., 5. ser., 9 (1897), pp. 7–20, dgms. 4*).

Calorimeter experiments with mammals—general laws of cooling by immersion in water, J. LEFÈVRE (*Arch. Physiol. Norm. et Path., 5. ser., 9 (1897), pp. 317–332, figs. 2, dgms. 6*).

Determination of the heat lost from the total surface of the body owing to the cooling action of water. Experiments with man, J. LEFÈVRE (*Arch. Physiol. Norm. et Path., 5. ser., 9 (1897), pp. 758–763, fig. 1, dgm. 1*).

The loss of heat from the body by immersion in water. Experiments with birds, J. LEFÈVRE (*Arch. Physiol. Norm. et Path., 5. ser., 9 (1897), pp. 802–809, dgms. 5*).

The influence of cold upon the secretion of urine, M. LAMBERT (*Arch. Physiol. Norm. et Path., 5. ser., 9 (1897), pp. 129–135, figs. 4*).

An apparatus for registering variations in weight, G. WEISS (*Arch. Physiol. Norm. et Path., 5. ser., 9 (1897), pp. 681–685, figs. 4*).—An apparatus for use in respiration experiments.

Advantages of modifying the rations fed to domestic animals with a view to protection against scarcity of food due to drought, and to rendering the feeding of animals more economical and remunerative, C. GORIO (*Bol. Not. Agr. 18 (1897), I, No. 2, pp. 86–89*).—A number of modified rations are suggested.

Best breeds of British stock; a practical guide for farmers and owners of live stock in England and the colonies (*London: W. Thacker & Co., 1898, pp. 130, pl. 1*).—This is a compilation of articles by a number of stock breeders, edited by John Watson.

Separator milk for calves, M. A. O'CALLAGHAN (*Agr. Gaz. N. S. Wales, 8 (1897), No. 7, pp. 486–489*).—A general article recommending that if skim milk is used care should be taken that the vessels containing it should be kept clean and that it be pasteurized.

Experiments on the bodily development of sheep, R. SENEQUIER (*Ann. École. Nat. Agr. Montpellier, 9 (1895–'96), pp. 218–233*).—Reprinted from Ann. Agron., 21 (1895), No. 9 (E. S. R., 8, p. 521).

The horse: Its external and internal organization (*London: George Philip & Son, pp. 24, ill.*).—An illustrated representation and brief description of the horse, revised and edited by George Fleming.

Ground grain vs. whole grain for chicks and capons, F. H. HALL (*New York State Sta. Bul. 126, popular ed., pp. 5, pls. 2*).—This is a popular summary of Bulletin 126 of the station (see p. 1076).

Profitable poultry farming, J. H. SUTCLIFFE (*London, 1897, pp. 128, ill.*).

DAIRY FARMING—DAIRYING.

Feeding dairy cows, C. D. SMITH (*Michigan Sta. Bul. 149, pp. 67–119, figs. 2*).—This bulletin consists of a popular discussion of the principles of feeding, calculations of rations, etc., with remarks on experiments in feeding the station herd. A record has been kept of the yields and amounts of the different kinds of feeding stuffs fed to the individual cows. While the general character of the ration was calculated beforehand, the quantity of both coarse fodder and of grain to be fed to the individual cows "was left entirely to the judgment of the man who fed the cows and who adjusted the quantity to the milk and the condition of the bowels." The coarse fodder consisted principally of silage, with some clover hay, cornstalks, millet hay, roots, etc. The grain consisted of various mixtures of corn, oats, bran, linseed meal, cotton-seed meal, gluten meal, and occasionally other by-products.

Analyses are given of the feeding stuffs mentioned, and of oat and pea silage, millet silage, Kafir corn silage, sorghum silage, lathyrus silage, lathyrus in full bloom, dried pasture grass, common millet seed, Hungarian seed, sorghum, and beans. The record of the cows for 3 winters is summarized, showing the amounts of the different kinds of food eaten per 1,000 lbs. live weight, the digestible food ingredients contained in the same, and the amount of butter fat produced per day. The cows are considered in 3 groups, *i. e.*, smaller cows, from 800 to nearly 1,200 lbs. in weight; larger cows, from 1,200 to 1,600 lbs., and cows nearly dry. The averages for each group of cows are summarized below:

Food eaten and fat produced per 1,000 pounds live weight daily.

	Food eaten.					Digestible nutrients in food.				Daily production of fat.
	Silage.	Mangel-wurzels.	Corn-stalks.	Hay.	Grain.	Dry matter.	Protein.	Carbohydrates.	Fat.	
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Nine smaller cows..	29.82	12.85	1.00	3.29	14.12	23.57	2.06	12.50	0.89	1.21
Three cows nearly dry	32.75	....	7.08	.33	6.23	15.20	1.09	8.20	.49	.23
Seven larger cows..	34.75	18.41	.50	2.50	12.15	22.11	1.89	12.23	.67	1.03

These averages are "presented as a standard ration for Michigan conditions. . . . The nutritive ratio of the standard ration suggested for the thousand-pound cows is 1:7.1, that of the larger cows 1:7.21, and that of the cows in the very latest months of the period of lactation is much wider, being 1:8.53."

The method of applying this standard in practice is discussed, and illustrations are given from the records of the cows to show that a standard can not be rigidly adhered to, but must be modified by the feeder to suit the requirements and capabilities of different cows.

Popular notes are given on the various feeding stuffs used. The results of two-years' trials in ensiling clover "show that it is possible to ensile clover, that the silage keeps well, and that stock will eat it with evident relish. . . . [but] it is cheaper to allow the sun to dry the hay than to draw the green forage to the barn." A half acre of rape yielded at the rate of 2,678 lbs. of dry matter per acre. "The cows ate the rape silage with evident relish, and no taint was imparted to the milk by it." Further experiments will be necessary to establish the practicability of rape either as green fodder or as silage as a cow feed. A comparison of the yields per acre and cost of growing carrots, mangel-wurzels, and ruta-bagas is given.

Effect of roots and potatoes on the digestibility of rations (pp. 106–110).—The digestibility of a basal ration with and without mangel-wurzels or potatoes was studied with 2 cows. The basal ration consisted of 14.5 lbs. clover hay, 6 lbs. bran, and 6 lbs. corn meal. The results follow:

Average coefficients of digestibility of rations with and without mangel-wurzels and potatoes.

Period.		Dry matter.	Crude protein.	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1	Basal ration with 20 lbs. mangel-wurzels	66.19	60.54	71.74	74.18	51.36	48.17
2	Basal ration	64.14	60.27	79.12	71.42	48.73	43.97
3	Basal ration with 15 lbs. potatoes	63.24	56.71	65.32	73.33	38.92	47.40

"In passing from period 1 to period 2 it is evident that the removal of the beets from the ration decreased the digestibility of the dry matter, ash, crude fiber, and nitrogen-free extract, while the digestibility of the protein remained constant. The addition of potatoes to the ration still further decreased the digestibility of the dry matter of the crude fiber and markedly lowered the digestibility of the protein. This result is undoubtedly due to the fact that potatoes are nearly clear starch, and the addition of so much starch to a normal ration lowers the digestibility of the protein, the fat, and the crude fiber."

Effect of potatoes and roots on the quality of the butter (pp. 110–116).—This was studied with 5 cows in periods of about 3 weeks, the results being compared with those on dry feed. The average time required for churning was 34 minutes when on dry feed, 36 minutes when on mangel-wurzels, and 86 minutes when on potatoes.

"On this point there was a very marked difference due to the feeding of potatoes. The cream fro hed badly in the churn and it took more than twice as long to bring the butter. . . . No important difference is noted in the composition of the butter that could be ascribed to the potatoes. In one case the butter was much harder where the cows had the potatoes, in another it was as soft as when the cows were on dry feed. The per cent of volatile fatty acids, the ingredients that give butter its characteristic flavor, was slightly higher on the average in the potato butter than in the butter from dry feed."

Brief mention is made of experiments in two successive winters to test the effect of gluten meal on the quality of butter.

"It was found as an invariable result that the gluten meal made the butter softer and made it difficult to so churn the cream as to extract all of the butter from the buttermilk. The per cent of fat in the buttermilk invariably increased from 0.1 per cent to 0.25 per cent, or even 0.5 per cent when gluten meal was fed."

The data are given of a study of the difference in composition of burr and roller process wheat bran, showing that "the roller-process brans are all perceptibly higher in protein than those of the burr-stone process."

Dairy barn (pp. 116–119).—A description is given of the new dairy barn built at the station in 1887. The barn is 45 by 70 ft., accommodates 30 cows, and cost $737.

Further investigations on the milk production of goats, KOHLSCHMIDT (*Landw. Jahrb., 26 (1897), No. 4–5, pp. 783–802*).—The author reports investigations on the yield and fat content of 16 Swiss goats, 11 native goats, and 4 crosses between the native and Swiss goats. The observations extended over a number of months. The yield and fat content of the milk from each of the 3 milkings daily are tabulated in detail.

With the Swiss goats the annual milk yield ranged from 421.91 to 911 liters, averaging 678.41 liters per head. The fat content of the milk of the 3 to 4 year old goats averaged 3.6 per cent, and of the younger animals 2.79 per cent for the entire period of lactation. The native goats gave from 674.72 to 1,255.44 liters of milk during the year, the average being 877.88 liters. The fat content ranged from 2.49 to 3.76 per cent, and averaged 3.07. The goats were milked 3 times daily. The milk from the noon milking was nearly always the richest in fat, and that from the morning's milking the poorest.

The source of milk fat, W. H. JORDAN and C. G. JENTER (*New York State Sta. Bul. 132, pp. 457–488*).—In this experiment a cow was fed for 2 weeks on normal food and then for 95 days following on a food from which the fat had been extracted as thoroughly as was possible. The milk was analyzed for 102 days; the urine and feces were collected and analyzed for 66 days, this being done continuously during 59 days of the time in which extracted foods were fed. A young grade Jersey cow, somewhat thin in flesh and about 4 months advanced in the period of lactation when the experiment was begun, was used. The food consisted of timothy hay, corn meal, and wheat gluten, the latter containing from 72 to over 74 per cent of protein. These foods were extracted by an oil company, and although repeated treatment failed to remove the fat entirely, the amount was so small that a fairly generous ration contained not over 0.13 lb. of ether extract per day.

"It is a matter of congratulation that the regular consumption of the rations was accomplished with a very satisfactory degree of success, considering the conditions under which the experiment was carried on. The health of the animal did not appear to be impaired by the food and treatment which she received."

The rations were varied at different times so as to furnish different amounts of air-dry food material and different amounts of protein, the decrease in protein being accompanied by an increase of carbohydrates.

The full data for the experiment are tabulated showing the composition of normal and extracted foods; the amount of food eaten; the composition of the milk, urine, feces, etc., and from these data the amounts of nitrogen and of fat consumed and extracted are calculated. Incidentally some data are given as to the comparative results of extraction of fat with sulphuric and petroleum ethers and the effect of drying upon the nitrogen content of cows' feces. The results as to the income and outgo of nitrogen and fat are summarized in the following tables:

Income and outgo of nitrogen.

Period.		Days in period.	Income.		Outgo.				Daily gain (+) or loss (—) of nitrogen.
			Total nitrogen in food.	Nitrogen digested.	Nitrogen in milk.	Nitrogen in urine.	Nitrogen in feces.	Total outgo of nitrogen.	
	Nitrogen balance.		*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*
1	Normal foods	7	1,307.6	862.5	325.4	523.3	445.1	1,293.8	+ 2.0
2	Same foods extracted	8	1,546.4	823.5	360.9	430.1	722.9	1,573.9	+ 4.1
3	Extracted foods with more nitrogen	7	1,552.4	942.2	302.1	436.0	610.2	1,348.3	+29.2
	Transition period	5	920.2	501.3	208.6	255.1	418.9	882.6	+ 7.8
4	Extracted foods with less nitrogen	8	1,158.4	523.8	284.6	267.5	634.6	1,186.7	— 3.5
5	Extracted foods, minimum ration	20	1,905.9	590.3	644.3	583.1	1,315.6	2,543.0	—31.8
	Transition period	3	373.2	206.0	93.4	88.9	167.2	349.5	+ 7.9
6	Extracted foods, same as in period 2	8	1,563.3	917.0	297.9	356.8	646.3	1,301.0	+32.8
	Totals on extracted food	59	9,019.8	4,504.1	2,191.8	2,417.5	4,515.7	9,125.0	....

Income and outgo of fat.

Period.		Days in period.	Income.		Outgo.			Total loss of fat.
			Total fat in food.	Fat digested.	Fat in milk.	Fat in feces.[1]	Total outgo of fat.	
	Fat balance.							
1	Normal foods	7	2,013.9	1,422.4	3,046.3	590.5	3,636.8	1,622.9
2	Same foods extracted	8	459.2	209.5	2,676.7	249.7	2,926.4	2,467.2
3	Extracted foods with more nitrogen	7	397.4	179.8	2,420.9	217.6	2,638.5	2,241.1
	Transition period	5	298.0	151.0	1,696.2	147.0	1,843.2	1,545.2
4	Extracted foods with less nitrogen	8	485.6	260.3	2,366.1	225.3	2,591.4	2,105.8
5	Extracted foods, minimum ration	20	802.8	374.3	5,280.5	428.5	5,709.0	4,906.2
	Transition period	3	124.6	66.6	709.5	58.0	767.5	642.9
6	Extracted foods, same as in period 2	8	472.3	248.8	2,434.0	223.5	2,658.3	2,186.0
	Totals on extracted foods	59	3,039.9	1,490.3	17,584.7	1,549.6	19,134.3	16,094.4
	Totals, including preliminary and supplementary periods	95	5,260.9	2,578.5	28,532.7	2,682.4	31,215.1	25,954.2

[1] The urine contains no fat.

Among the author's conclusions are the following:

"(1) A cow fed during 95 days on a ration from which the fats had been nearly all extracted continued to secrete milk similar to that produced when fed on the same kinds of hay and grain in their normal condition.

"(2) The yield of milk fat during the 95 days was 62.9 lbs. The food fat eaten during this time was 11.6 lbs., 5.7 lbs. only of which was digested; consequently at least 57.2 lbs. of the milk fat must have had some source other than the food fat.

"(3) The milk fat could not have come from previously stored body fat. This assertion is supported by three considerations: (1) The cow's body could have contained scarcely more than 60 lbs. of fat at the beginning of the experiment; (2) she gained 47 lbs. in body weight during this period of time with no increase of body nitrogen, and was judged to be a much fatter cow at the end; (3) the formation of this quantity of milk fat from the body fat would have caused a marked condition of emaciation, which, because of an increase in the body weight, would have required the improbable increase in the body of 104 lbs. of water and intestinal contents.

"(4) During 59 consecutive days 38.8 lbs. of milk fat was secreted and the urine nitrogen was equivalent to 33.3 lbs. of protein. According to any accepted method of interpretation, not over 17 lbs. of fat could have been produced from this amount of metabolized protein."

As to the source of milk fat, the conclusion is reached that in these experiments the milk fat "was produced, in part at least, from carbohydrates, as previous experiments have demonstrated to be the case with body fat."

It is pointed out that, while the German standard calls for 2.5 lbs. of protein per day, an average yield of 30 lbs. of milk would not contain over 1 lb. of protein, leaving 1.5 lbs. of protein unused, so far as known, for necessary constructive purposes. It is shown that—

"The quantity of milk solids secreted bore a definite relation neither to the digestible protein eaten nor to the extent of the protein metabolism. . . . The extent of protein metabolism seems to be influenced mainly by the protein supply rather than by the quantity of milk solids secreted. . . .

"We desire to propose as a rational explanation of the notable influence upon milk secretion of an abundant supply of digestible protein in the ration that it is due to the influence of protein upon metabolic activity rather than because so much was needed from which to form milk solids. This view would not minimize our estimate of the importance of the nitrogenous constituents of cattle foods, but simply emphasizes more fully one reason, and perhaps the main one, why they should be supplied in such generous proportions.

"[As to the composition of the milk], this bore no definite relation to the amount and kind of food.

"Neither a deficiency in the protein of the ration nor a depression of the digestible nutrients to about 5.5 lbs. per day caused the cow to produce poorer milk. The only apparent effect was in changing the quantity of product. . . .

"The changes in the proportion of milk solids were due almost wholly to changes in the percentage of [milk] fat."

Investigations on the composition of colostrum and the change to normal milk, F. G. DEISSMANN (*Inaug. Diss., Heidelberg, 1897, pp. 98*).—The author introduces the account of his investigations with a quite thorough review of work previously published on the subject. His investigations were made on 3 cows and 2 sheep. Complete analyses were made of the milk immediately after calving and at short intervals, usually four hours, for several days, after which the analyses were continued at longer intervals for some time. In addition to analyses, the physical properties of the samples, behavior toward rennet and toward heating, etc., were noted.

In the case of 1 cow (North Ditmarsh) 5½ kg. of colostrum was milked seven hours before calving to relieve the cow. It had a red color and contained numerous blood corpuscles. Immediately after calving the colostrum was a yellowish brown color, and no blood corpuscles could be recognized.

A portion of the analyses of the cow's milk for the first four days after calving are given below.

Analyses of colostrum of three cows.

	Total solids.	Fat.	Nitrogen.			Total albuminoids.[1]	Ash.
			Total.	Albuminoid.	Nonalbuminoid.		
North Ditmarsh cow (6 yrs. old):	*Per ct.*	*Per ct.*	*Per ct.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per ct.*
Seven hours before calving	19.56	2.97	2.08	1.51	0.57	9.64	0.85
Immediately after calving	23.21	5.10	2.19	2.03	.15	12.95	.79
Four hours after calving	17.65	3.48	1.71	1.55	.16	9.91	.60
Twelve hours after calving	13.95	1.78	1.16	.93	.23	5.95	.84
Twenty-four hours after calving	12.93	1.51	.84	.73	.11	4.63	.81
Two days after calving	9.50	2.27	.65	.60	.04	3.85	.80
Three days after calving	14.13	4.63	.61	.57	.04	3.66	.72
Four days after calving	14.47	4.78	.65	.60	.05	3.82	.74
Simmenthaler cow (4 yrs. old):							
Immediately after calving	27.91	5.52	3.14	2.26	.89	14.37	1.04
Four hours after calving	26.30	7.63	2.30	1.32	.98	8.41	1.02
Twelve hours after calving	15.77	3.37	1.22	.88	.34	5.59	.75
Twenty-nine hours after calving	14.19	4.14	.84	.69	.15	4.40	.89
Two days after calving	15.60	4.84	.71	.62	.09	3.94	.79
Three days after calving	15.72	4.26	.68	.56	.11	3.59	.83
Four and one-half days after calving	12.83	3.69	.57	.53	.03	3.41	.81
Dutch cow (6 yrs. old):							
Immediately after calving	26.11	(2)	2.41	2.27	.15	14.43	.82
Four hours after calving	20.23	....	2.10	1.48	.62	9.42	.74
Twelve hours after calving	16.27	....	1.60	1.08	.52	6.87	.88
Thirty-two hours after calving	15.92	....	1.24	1.07	.17	6.78	.77
Two and one-third days after calving	15.40	4.43	.97	.81	.16	5.17	.92
Nearly four days after calving	13.59	3.46	.77	.66	.10	4.24	.60

[1] Albuminoid nitrogen × 6.37. [2] Fat determinations lost.

There appeared to be no characteristic relationship between breed and the composition of the colostrum. The greatest change in the colostrum took place within the first few hours after calving. It gradually became like normal milk, which it resembled in outward appearance and in its behavior toward rennet and toward heating, in from three to four days, although not constant in composition until several days later. The colostrum of the Dutch cow differed from that of the others in giving an amphoteric reaction 12 hours after calving, while that of the other cows was acid for the first three or four days. In no case did the colostrum have an unpleasant odor or taste, and this was true of the colostrum of 8 other cows which was tested.

The colostrum contained considerable quantities of nonalbuminoid nitrogen, which diminished after a day or two, although small quantities were found in the normal milk. It is believed to have consisted principally of urea, although amids may have been present also.

The colostrum from the sheep contained more casein than albumin and did not contain nearly as much total albuminoids as that from cows. It contained some nonalbuminoid nitrogen, the amount of which was not uniform. Small amounts of lactoprotein and lactoglobulin were detected. Like the colostrum from cows, sheep's colostrum had no characteristic taste or odor.

Some conditions affecting churning with churns of different construction, E. J. VON STOCKHAUSEN (*Inaug. Diss., Leipsic, 1897, pp. 87*).—Following a review of the literature, the author reports 90 experiments with four different churns. These were (1) the Davis Swing churn; (2) the Saxonia churn—a revolving square churn with dasher arrangement, (3) the Victoria churn—an ordinary barrel churn—and (4) the Holstein churn—a stationary churn with dasher. The experiments were made in the experimental creamery of the university. The milk used was mixed milk of quite constant composition. The cream was separated in a hand separator, and after testing for fat was made to a constant content of 20 per cent of fat by the addition of skim milk. In about half the cases the cream was churned sweet, and in the balance of the cases it was ripened for 24 hours, showing about 30° of acidity with decinormal soda solution. The experiments were also varied in the amount of cream placed in the churn and in the temperature of the cream at the beginning of churning. The full data for each experiment as to amount and composition of the cream, buttermilk, and butter; the temperature; time required for churning, and percentage of churnability are tabulated. No averages are given, but the best results obtained with the four different churns are summarized as follows:

Best results with different churns.

	Experiment No.	"Fullness" of churn.	Temperature of cream.	Time of churning.	Churnability.
			° C.	Min.	Per ct.
Davis Swing churn, sour cream	15	$\frac{1}{4}$	16	25	97.75
Do	16	$\frac{1}{4}$	16	25	97.96
Saxonia churn, sour cream	37	$\frac{1}{4}$	14	50	98.35
Do	38	$\frac{1}{4}$	14	48	98.31
Victoria churn, sweet cream	49	$\frac{1}{7}$	10	70	99.25
Do	50	$\frac{1}{7}$	10	65	98.51
Victoria churn, sour cream	65	$\frac{1}{5}$	14	57	98.12
Do	66	$\frac{1}{5}$	14	57	98.10
Holstein churn, sour cream	85	$\frac{1}{4}$	16	35	99.27
Do	86	$\frac{1}{4}$	16	30	99.28

The author concludes that on the whole the Holstein churn gave the best results, although he states that usually a smaller relative amount of cream was churned in the Holstein churn than in the Victoria. He concludes further that: (1) Sour cream churns more rapidly than sweet cream and gives the larger yield of butter. (2) The time required for churning varies with the amount of cream in the churn ("fullness"). With an increase in the amount of cream there is an increase in the churnability until the optimum is reached, beyond which the time required for churning increases and the churnability diminishes. (3)

Increasing the temperature of the cream at the beginning of churning decreases the time required for churning, but usually also decreases the churnability.

While the time required for churning sweet cream in the Holstein and Saxonia churns was very unfavorable, with the Davis Swing and Victoria churns sweet cream could be churned quite rapidly, provided only a limited quantity of cream was churned at once. With the latter churns the churnability of sweet and sour cream were approximately the same. The sour cream usually gave a butter of better appearance than sweet cream, although the sweet-cream butter usually had a more delicate flavor. The quality of the butter suffered specially when the cream was too sour, as more casein was incorporated into the butter, which affected its keeping quality.

Regarding the second point, attention is called to the amount of cream which can be satisfactorily churned in a churn, beyond which the time required for churning increases and the completeness of churning decreases. As a rule, filling the churn from $\frac{1}{4}$ to less than $\frac{1}{2}$ full gave the best results. The churning was rapid and complete with sweet cream only when a small amount of cream was used, but the results were satisfactory with sour cream when the churn was $\frac{1}{3}$ full. The churnability began to decrease when the churn was $\frac{3}{8}$ full in the case of the Saxonia, $\frac{1}{2}$ full in the case of the Holstein, and $\frac{1}{5}$ full in the case of the Victoria churn. An increase in the temperature at the beginning of churning diminished the time required for churning, but diminished the yield of butter also. Furthermore, an increase in the temperature of sweet cream caused soft butter.

In conclusion, remarks are made on the construction of the different churns and their adaptability to different purposes.

Milk yields of Norwegian and of Danish cows (*Norsk Landmansblad., 17 (1898), No. 4, pp. 41, 42*).

Angler cows and their yields of milk fat (*Tidskr. Landtmän, 18, No. 40, pp. 723–725*).

A feeding and work schedule for the cow barn, A. STAHRE (*Landtmannen, 8 (1897), No. 39, pp. 545–550*).

Control of the productive capacity of the cow, H. P. LARSEN (*Kontrol med Koens Mälkeydelse og Mälkens Fedtindhold. Jydsk Forlagsforretning*).

Milk fat from fat-free food, F. H. HALL (*New York State Sta. Bul. 132, popular ed., pp. 6*).—This is a popular summary of Bulletin 132 of the station (see p. 1083).

Preliminary report on refrigerating machines for use in dairying, E. P. BONNESEN (*Tidsskr. Landökon., 16 (1897), No. 7–8, pp. 675–681*).

Refrigerating machines vs. ice houses for creameries, B. BÖGGILD (*Landmansblade, 30 (1897), No. 45, pp. 622–624*).

On the application of pure cultures in sour-cream butter making, J. LARSON (*Mejeri Prakt., 1 (1897), No. 1, pp. 2, 3, et seq.*).

Some bacteria that curdle milk, R. R. DINWIDDIE (*Amer. Mo. Micros. Jour., 19 (1898), No. 1, pp. 3–6, figs. 3*).—Describes *Micrococcus uberis* and *Bacterium discissum*.

On Alpha separators and their care, T. BERG (*Mejeri Prakt., 1 (1897), No. 1, pp. 1–2, et seq.*).

Cooperative creameries and tuberculosis, H. NATHORST (*Nord Mejeri Tidn., 12 (1897), No. 44, pp. 519, 520*).

Investigations of some faults in the consistency (grain) of butter, and the causes of their appearance, V. STORCH (*Tidsskr. Landökon., 16 (1897), No. 5–6, pp. 537–568*).

Swedish butter exhibitions during 1896, N. ENGSTRÖM (*Landtmannen, 8 (1897), No. 42, pp. 597–600*).—Abstract of the report published by the Swedish Agricultural Department as *Meddelanden från Kongl. Landtbruksstyrelsen*, No. 6, 1897.

Pocketbook for dairymen for 1898, H. APPEL (*Lommebog for Mejerister, 1898. Copenhagen, 1897, pp. 257*).

Dairying in Norway in 1897 (*Norsk Landmansblad, 17 (1898), No. 3, pp. 25–28*).

VETERINARY SCIENCE AND PRACTICE.

Report on the results of the investigations by the commission for the study of the foot and mouth disease at the Institute for Infectious Diseases at Berlin, LOEFFLER and FROSCH (*Centbl. Bakt. u. Par., 1. Abt., 22 (1897), No. 10–11, pp. 257–259*).—According to this report the bacteria hitherto found and considered to be the cause of the disease are accidental. A protozoan element, not the Sigel Bussenius bacillus, seems to be the cause. Cattle and swine are especially susceptible, while sheep, goats, dogs, guineas, house and field mice, and birds are not subject to artificial infection with lymph containing this element. Lymph from the vascular tracts affords the surest means for infection by injection into peritoneal cavities or into muscles, as also by rubbing on abraded mucous membranes. In animals injected intravenously fever appears in from one to three days, according to the amount and the virulence of the lymph. Blisters appear first in the mouth (in milch cows also on the udder) and in from one to two days later on the feet. The blisters on the udder and the feet arise not from external infection, but from the virus circulating in the blood. When they appear the virus disappears from the vascular tracts.

For the purpose of injection 1/5,000 cc. of fresh lymph is sufficient, smaller amounts, to 1/20,000 cc., are uncertain, and anything smaller than 1/20,000 cc. is inoperative. The infective properties of the lymph are destroyed by heating for twelve hours at 37° C. or at 70° C. for half an hour, or by drying for twenty-four hours at summer temperature. Kept in capillary tubes in an ice chest it retains its powers for fourteen days, sometimes longer.

Contrary to the published views of veterinary authorities, in the greater number of affected animals sickness brings about immunity in from two to three weeks after their becoming sick. Some animals are naturally immune, others are very susceptible and become immune only after a second illness.

Some substance occurs in the blood of immune animals injected with fresh lymph that renders the lymph powerless when mixed with the blood of such animals and injected into susceptible animals.

Cattle and swine may be made immune by inoculation with such a mixture or by lymph warmed to the proper infecting point. Most animals require but one injection. and this may not apparently make the animal sick. The final conclusion of the commission is that it seems absolutely certain that the foot and mouth disease can be successfully combated by means of inoculation.

Report of the veterinary service and meat control in Norway for 1895, O. MALM (*Ber. om Veterinär-väsenet og Kjödkontrollen i Norge, 1895, Norges Offic, Statistik, Räkke 3, No. 270. Christiania, 1897, pp. 203*).—This report has a résumé in French.

The only part of the report of general interest is that describing the results of the tuberculin tests conducted since the spring of 1895 under the auspices and at the expense of the Norwegian Government. All owners of cattle who agree to comply with the regulations prescribed for the control of bovine tuberculosis are entitled to have their cattle tested free of charge. The sum of 10,000 kroner ($2,680) was appropriated to defray the expenses of the tuberculin tests in 1895–'96, and for the two following years 15,000 ($4,020) and 18,000 kroner ($4,824) were appropriated. The main results of the investigations are given below.

Up to date 2,195 different herds, aggregating 30,787 head of cattle, have been examined. Of these 8.4 per cent were found to be tuberculous and 26.1 per cent reacted under the tuberculin test. In the majority of herds only individual cases were found, and these, almost without exception, were recently purchased animals. The results show that in comparison with other European countries where similar statistics are available, and particularly in comparison with Swedish, Danish, and German cattle, tuberculosis is not so prevalent among the cattle of Norway. The results of the examination are given in the following table:

Distribution of bovine tuberculosis in Norway.

	Breeds.					Ages.				
	Native.	Telemark.	Ayrshire.	Mixed.	Miscellaneous.	Under 6 mos.	6 mos.–1 year.	1–5 years.	Over 5 years.	Age not given.
Total number examined	13,548	2,174	692	13,506	867	1,551	2,237	13,179	13,449	371
Percentage tuberculous	6.8	6.1	18.4	10.4	7.2	1.0	3.4	7.9	10.3	18.9

The veterinarians making the tests reported repeatedly that consumption in man was found, or had been found, on farms where bovine tuberculosis was shown to be present.

The laws and regulations governing tuberculin tests, meat control, and other branches of the veterinary service are given in the report.—F. W. WOLL.

Powdered soap as a cause of death among swill-fed hogs, V. A. MOORE (*New York Cornell Sta. Bul. 141, pp. 409, 418*).—An account is given of a series of experiments in feeding pigs with powdered soaps such as are used in washing dishes, etc., in hotels, and which eventually find their way into swill barrels.

According to the analyses made by G. W. Cavanaugh, the assistant chemist, these soaps contain from 49.6 to 55.04 per cent of sal soda. When the soap was fed to pigs in amounts varying from $\frac{1}{2}$ to 5 oz. per day they became sick and showed all the symptoms that had been observed in hogs fed upon swill that contained soap in greater or less amount. Diarrhea was a constant symptom. In severe cases there was much difficulty in standing and the muscles of the head and legs were more or less constantly jerking. Connected with these symptoms there was a loss of appetite. Where the pigs recovered from the immediate effects they did not become thrifty for some weeks. A post-mortem examination of those that died showed the skin between the thighs to be of a pinkish color, kidneys pale, the blood vessels of the mesentery much congested, the mesenteric glands enlarged and œdematous, many congested, the mucous membrane of the intestines of a dark reddish color, the brain very much congested, and the mucosa of the stomach covered with a thick layer of mucus.

Bacteriological examinations brought to light no evidence of bacteria. Check experiments were made. In conclusion, it is noted that the greatest amount of loss from swine disease in the State is among hogs fed on swill collected from hotels, boarding houses, and other large institutions; that the cause of the death in certain outbreaks among such swill-fed hogs is due to the poisoning of the animals by an excess of free alkali in the swill. Small quantities of the powdered soaps produced no immediate bad results, but it is not safe to feed them to animals. The proper channel for the disposal of dish water is the sewer.

Cashew [mesquite] poisoning, WILLIAMS (*Jour. Jamaica Agr. Soc., 1 (1897), No. 9, pp. 319–321.*—When animals are fed with this legume (*Prosopis juliflora*) they become slick, glossy, and look well. The animals seem very fond of it. But when it is damaged by rains, heavy dews, etc., it is poisonous. Animals that eat it when it is in the poisonous condition become distended with gas and rupture of the digestive system may result. Clots of blood have been found in the cerebellum. The first symptoms are colicky pains with abdominal distension; the animal paws, lies down and rises frequently, and shows an inclination to thrust its head into corners. It may lie on its back with feet doubled up and groan with pain. Cold sweats occur, breathing becomes thick and labored, and there are frequent attempts at micturition. Urine is voided in small quantities. The remedy is puncturing the abdomen and drawing off the gases, together with hot fomentations to abdomen and loins and the administration of oil and hot water enemas. The animal may finally die from collapse.

On Drepanidotænia hemignathi, a new species of tapeworm, A. E. SHIPLEY (*Quart. Jour. Micros. Sci.* [*London*], *n. ser., 40 (1898), No. 4, pp. 613–623, pl. 1*).—This species is based on ten specimens from the intestine of *Hemignathus procerus* from the Sandwich Islands. It varies from 1 to 2.2 cm. in length and at the middle of the body is 2 mm.

broad. The head is provided with a row of ten hooks each from 18 to 23μ long. The segmentation begins close behind the head, having scarcely any neck. The genital pores are unilateral. Eggs, spherical, 40 to 50μ in diameter.

In the length of the hooks the species resembles *D. tenuirostris* in which they are 20 to 23μ long. In the embryo of *D. hemignathi* the hooks are 20μ, in the embryo *D. tenuirostris* only 7μ. The species differ further in the longer neck in the last-named form and in its larger egg.

On the "leucocide" substances in the metabolic products of Staphylococcus pyogenes aureus, O. BAIL (*Arch. Hyg., 32 (1898), No. 1–2, pp. 133–171*).

Researches on the influence of the organism on toxins, E. METCHNIKOFF (*Ann. Inst. Pasteur, 11 (1897), No. 11, pp. 801–809*).—The author concludes that plants such as bacteria and fungi can destroy toxins and transform them into vaccines without producing an antitoxin; that the invertebrates are capable of producing a tetanic antitoxin in appreciable quantities; that the production of antitoxins begins in the animal series with the crocodiles, where the power is more highly developed than in the higher animals; that the antitoxic power is not to be considered as bound to any febril reaction whatever; that the antitoxic property of the fowl is in the blood; that it is not possible to accept the idea that natural immunity depends on the antitoxic power, and that the antitoxic property in the animal kingdom has an evolution less ancient than the phagocytic reaction.

Helminthological contributions, A. MÜLLER (*Arch. Naturgesch., 63 (1897), pp. 1–26, pls. 3; abs. in Zool. Centbl., 5 (1898), No. 2, pp. 49*).—A description is given of *Spiroptera truncata* Crpl., from *Coriacias garrula*, and of *Filaria capitellata* Schn., which is regarded as identical with *Hystrichis papillosa* Rud., from *C. garrula. Dispharagus anthuris* of Rudolphi, Molin, and Dujardin is to be separated from *F. anthuris* of Schneider and von Linstow; the name of the latter must be retained, while the former species, which is found between the gastric membranes of *Lanius collurio, L. rufus*, and *Coracias garrula*, must be called *Dispharagus cordatus*. There are also described: *F. recta* v. Linst, from *Podiceps cristatus; F. involuta* v. Linst, from *Ægolius otus; F. tricuspis* Fedt, from *Corvus corone;* an unknown Ascaris from the œsophagus and stomach of *Felis tigris; Heterakis compar* Schrank, from *Tetrao urogallus* and *T. tetrix; Ankylostomum trigonocephalum* Rud., from *Canis vulpes; Strongylus nodularis* Rud., from *Fulica atra; S. retortæformis* Rud., from Lepus; *Crenosoma semiarmatum* Molin, from *Canis vulpes;* and *Ancryacanthus bihamatus* n. sp., from *Sterna risoria*.

Fecundation in Ascaris megalocephala, J. B. CARNOY and H. LEBRUN (*Cellule, 13 (1897), pp. 60–195, pls. 2; abs. in Zool. Centbl., 5 (1898), 3, pp. 79–84*).

Contributions to the structure of protoplasm, the karyokinetic spindle, and the centrosome. I, On the fertilization and first division of the egg of Ascaris, R. VON ERLANGER (*Arch. Mikros. Anat., 49 (1897), pp. 309–440, pls. 3; abs. in Zool. Centbl., 5 (1898), No. 3, pp. 74–79*).

The genus Ascaris, M. STOSSICH (*Il genre Ascaris Linné. Trieste, 1896, pp. 114*).—A toxonomic description is given of 217 species. Their synonymy seems to be fully brought out, and hosts and localities are usually mentioned. In the systematic index given the parasites are noted under the names of their hosts arranged in zoological order. From this it appears that 77 species of mammals, 170 of birds, 37 of reptiles, 5 of amphibians, 142 of fishes, and 1 of insects are affected.

The single insect host is *Pterostichus niger*, which harbors *Ascaris pterostichi*.

Bothriocephalus zschokkei, M. LÜHE (*Zool. Anz., 20, No. 544, pp. 430–434; abs. in Zool. Centbl., 5 (1897), No. 2, p. 47*).—*Bothriocephalus zschokkei* is thought synonymous with *Schistocephalus dimorphus*.

A preliminary contribution on the anatomy of Tænia polymorpha, K. WOLFFHUGEL (*Zool. Anz., 21, No. 554, pp. 211–213*).—The testis, vas deferens, and cirrus apparatus are paired; the female genital glands and the uterus simple; the vagina does not communicate with the outer world; the cirrus bores directly into the parenchyma, breaking through the cuticula at places that are not predetermined.

These facts are thought to be of sufficient weight for the creation of a genus, but this is deferred until the relationships are considered in a later paper.

On the œsophagus of nematodes, especially of Strongylus armatus and Dochmius duodenalis, L. A. JAGERSKIOLD (*Bihang Svenska Vetensk. Akad. Handl., 23 (1897), IV, No. 5, pp. 1-26, pls. 2; abs. in Zool. Centbl., 5 (1897), No. 2, p. 48*).—The author finds that the glands in the dorsal side of the œsophagus in *Strongylus armatus* and *Ankylostomum duodenale* open into the oral cavity at its anterior end.

The strongylus of the sheep's stomach, C. JULIEN, (*Jour. Agr. Prat., 1 (1898), No. 4, pp. 137-142, figs. 5*).—The affected animals are caused to drink a glass of water with some linseed oil in which there is mixed at the moment of administration 5 to 6 cc. of benzin for lambs or 6 to 8 cc. for sheep. If the animal is very sick the dose should be graduated, beginning with 2 to 3 cc.

Bothriotænia chilensis, n. sp., E. RIGGENBACH (*Actes Soc. Sci. Chile, 7, (1897), pp. 66-73, pl. 1; abs. in Zool. Centbl., 5 (1897), No. 2, p. 47*).—This new species was taken from *Genypterus chilensis* and reaches a length of 5 cm. The scolex bears 2 flask-like independent bothridia. The genital pores lie irregularly and alternatingly on both sides of the body, the uterus opening on the ventral surface of the proglottid. The body surface is covered with pores of fine and numerous excretory vessels.

The development of the sporozoa of the genus Coccidium, P. L. SIMOND (*Ann. Inst. Pasteur, 11 (1897), No. 6, pp. 546-581, pls. 2*).—By means of experiments on rabbits and on *Salamandra maculata* and by microscopical observations the author has found that *Coccidium oviforme* and *C. (Karyophagus) salamandræ*, instead of being dimorphic in their cycle of development, are polymorphic. What applies to this applies with slight modification also to *C. proprium* and, in all probability, to the rest of the genus.

New worms from Eritrea, E. SETTI (*Atti Soc. Ligust Sci. Nat. e Geogr. Genova, 8 (1897), pt. II, pp. 1-51, pls. 2; abs. in Zool. Centbl., 5 (1898), No. 2, p. 49*).—The new form *Oxyuris stossichii* from the intestine of *Hystrix cristata* is described.

Tuberculosis in cattle (*Ontario Dept. Agr., Spec. Bul. 1897, July, pp. 12, pls. 2*).—This is a popular bulletin designed to awaken the attention of Canadian cattle breeders to the widespread existence of tuberculosis, giving popular directions for testing suspected animals, enumerating the utensils used in making the tests, and stating where the instruments may be obtained.

TECHNOLOGY.

Beet sugar production in Sweden (*Tidskr. Landtmän, 18, No. 6, pp. 96-99*).—The total quantity of beets worked during the campaign of 1895-'96 was 535,149.4 tons. The products obtained were 54,822.41 tons first sugars, 5,371.86 seconds, 1,920.61 thirds (total, 62,114.88 tons), and 15,753.4 tons of molasses. The amount of sugar obtained was 11.75 per cent and that of molasses 2.94 per cent of the tonnage of beets. The average content of polarized sugar in the beets was 13.45 per cent, the range in the average per cent for all factories being from 12.18 to 14.51 per cent. The average sugar content in single factories ranged between 9.3 and 15.8 per cent.

The factory at Roma, Gotland, which is largely, if not entirely, supplied by beets grown on marsh soils, received the richest beets. The average content of sugar in the beets was 15 per cent, the percentage ranging from 14.5 to 15.8. The yield of sugar was 12.75 per cent and that of molasses 3.02 per cent of the tonnage of beets worked.

The following comparative statistics are considered of interest in this connection:

Beet sugar production in Sweden, Germany, and France, 1891-'96.

Campaign.	Sweden.			Germany.			France.		
	No. of factories.	Average quantity of beets worked.	Yield of crude sugar from beets.	No. of factories.	Average quantity of beets worked.	Yield of crude sugar from beets.	No. of factories.	Average quantity of beets worked.	Yield of crude sugar from beets.
		Tons.	*Per cent.*		*Tons.*	*Per cent.*		*Tons.*	*Per cent.*
1891-'92	8	32,509	10.26	403	23,543	12.06	368	15,287	11.41
1892-'93	10	27,745	10.80	401	24,468	11.94	367	14,872	10.62
1893-'94	10	37,396	11.42	405	26,279	12.34	370	14,251	10.89
1894-'95	[1] 17	36,969	11.60	405	35,865	12.15	367	19,449	10.38
1895-'96	[1] 18	31,479	11.75	397	29.402	13.11	356	15,201	11.55

[1] At 3 of the factories only the juice was extracted, which was then sent to the other factories for the remaining processes of manufacture.

—F. W. WOLL.

An experiment in generating vinegar, W. B. ALWOOD (*Virginia Sta. Bul. 71, pp. 123-128*).—This is a continuation of the work reported in Bulletin 57 of the station (E. S. R., 8, p. 977). The object of the work was "to determine the feasibility of manufacturing vinegar by modern methods on the average farm." The vinegar generator used consisted of a 4 by 8 ft. wooden tank filled with beech shavings. The tank was provided with holes near the bottom for the admission of air, and fitted 1 ft. from the top with a wooden disk perforated to allow the entrance of the cider, which was distributed evenly over it by means of a dumper. The vinegar was drawn from the tank by means of a siphon of glass tubing inserted in a hole near the bottom. The temperature of the fermenting cider in the mass of shavings was controlled by regulating the supply of air, some of the air holes being shut off when the temperature rose too high and opened when it fell too low.

In order to acidify the shavings and start the process of fermentation, the generator was charged with strong vinegar and again with vinegar in which some concentrated grape juice was dissolved. The stock solution, a mixture of weak vinegar and fermented cider, was then run through the generator at the rate of 20 gal. per day (24 hours). The resulting product was a very good vinegar, ranging from 4.05 to 5.87 per cent acid. A mixture of half vinegar and half fresh cider failed to produce good vinegar without being run through the generator twice. Better results were obtained by allowing the cider to ferment for some time in casks before running it through the generator. The temperature within the generator 2 ft. from the bottom ranged from 88 to 106°. The higher temperature caused a loss of alcohol and lowered the acidity of the product. Temperatures below 90° did not give good results. The optimum is thought to be about 95°.

It is believed that this method of manufacturing vinegar might be used with considerable profit if it were not for the cheap vinegars made as by-products from various factories and colored and flavored to imitate cider vinegar.

On the manufacture of potato starch, M. J. KJUS (*Tidsskr. Norske Landbr., 4 (1897), No. 5, pp. 203–208*).—The process is described and the machinery illustrated.

Hydromel, G. DE LAYENS (*L'Hydromel. Paris: Paul Dupont, 1894, pp. 20, figs. 3*).—A brief pamphlet discussing the various questions connected with the making of hydromel. It is estimated that hydromel is worth $1\frac{1}{2}$ francs per liter; and since about a pound of honey is required to make each liter, deducting the expense of fermentation, etc., it raises the price of honey to about 75 centimes per pound. The formula for making hydromel is water 75 liters, honey 25 liters, tartaric acid 50 grams, bismuth 10 grams, fresh pollen 50 grams.

Contribution to the study of oxydase of grapes—its utility in vinification, A. BOUFFARD and L. SEMICHON (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 5, pp. 423–426*).

Wine making, M. BLUNNO (*Agr. Gaz. New South Wales, 9 (1898), pt. 1, pp. 1–31, pl. 1, figs. 17*).

The preparation of white wines from red grapes, V. MARTINAND (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 9, p. 656*).

Concerning so-called boiled wine (vini cotti), G. PARIS (*Ztschr. Untersuch. Nahr. u. Genussmtl., 1898, No. 3, pp. 164–167*).—Analyses of a number of samples are reported.

The temperature of wine fermentation, L. ROOS (*Prog. Agr. et Vit., 29 (1898), No. 12, pp. 358–363*).

The discoloration of wine (la casse des vins), A. BOUFFARD (*Ann. École Nat. Agr. Montpellier, 9 (1895–'96), pp. 197–212*).—The author classifies the changes which the coloring matter of wine undergoes, all of which have been more or less confused. As defined by him they are (1) the decomposition of the coloring matter through bacterial agencies; (2) the bluing of wines due to the chemical oxidation of certain wines; (3) the precipitation of coloring matter due to chemical action; and (4) the rapid oxidation and precipitation of the coloring matter through chemical changes induced by the presence of the ferment, oxydase.

The latter class alone should be considered under the name "la casse des vins." In this class of change, heating the wine to 65 to 70° C., or sulphuring, will, to a great degree, prevent the discoloration.

The microorganisms of the brewing industry, A. JÖRGENSEN (*Die Mikroorganismen der Gärungsindustrie. Berlin: Paul Parey, 1898, 4. ed., pp. VIII, 349, figs. 79*).

On the olive oil of Dauro, Portugal, A. J. FERREIRA DA SILVA (*Bul. Soc. Chim. Paris, 3. ser., 19 (1898), No. 2, pp. 88–90*).

Peanut oil and its uses in pharmacy and the arts, S. P. SADTLER (*Proc. Amer. Pharm. Assoc., 45 (1897), pp. 179–182*).—The successful substitution of peanut oil for olive oil in some pharmaceutical preparations is reported.

AGRICULTURAL ENGINEERING.

Report of the section of meteorology and irrigation engineering, L. G. CARPENTER (*Colorado Sta. Rpt. 1897, pp. 62–85, 93, 94, 106–108, figs. 4*).—A summary is given of the work of this department of the station during the year in the measurement of return waters from irrigation, evaporation from reservoirs, water available for irrigation in different streams, the rise and fall of water in streams, with fluctuations in rainfall and temperature, duty of water on farms, observations on ground water, duration of sunshine, measurements of solar energy, soil temperatures, atmospheric pressure, etc.

Measurements of return waters from irrigation in the same line as those of previous years[1] were made in 1897 on the Big Thompson and its tributary, the Little Thompson, the Rio Grande, and the Cache la Poudre. The measurements on the Rio Grande showed that the return of water to that stream is small, but for a portion of its length it is losing a large amount of water from its bed. For 10 miles of its course this loss was found to amount to from 75 to 100 cu. ft. per second. Measurements on the Cache la Poudre indicate that the losses are not large enough to justify the use of any means of saving the water. The Big Thompson and the Little Thompson showed a gain of 70 cu. ft. per second from return water. Since these gains of the streams must be due at least in part to losses from canals, measurements were undertaken along about 70 miles of canal to ascertain the losses from seepage. Losses were found in different canals varying from "a depth of 1 ft. in 24 hours over the canal surface to a depth of over 20 ft. in the same time. The average loss of canals in good condition may be put provisionally at 2 ft. in 24 hours."

Observations were made on the amount of evaporation from the surface of a number of lakes, which indicated that the loss from this source was over one-half greater than that recorded in a standard evaporation tank in the college grounds, which was 41 in.

The amounts of water furnished by the Cache la Poudre River during the year, as recorded by a self-registering instrument placed at the point where the river flows out of the mountains and above all the ditches except one, were reported in weekly bulletins, which were supplied to the local press, "so that the irrigation interests should know something of the stage of water and of the probable changes to be expected." The instrument used in recording the water supply in the river is described. In connection with the river records rainfall stations were maintained at various places in the mountains, and in a few places temperature observations were made. These observations promise to be of considerable value in predicting the rise of water in different mountain streams.

The amounts of water used for irrigation on certain farms were recorded as in previous years, and observations have been made on the fluctuation in the level of ground water. Investigations on the water supply, especially the artesian water of the San Luis Valley, were continued in 1897. It is believed that this valley was the bed of an ancient lake, or rather of two lakes at different periods. This explains why a portion of the valley is water-logged, and also why certain of the shallower artesian wells furnish water which is unfit for drinking purposes. A contour map has been prepared which shows that the water-logged soils can be drained, and it is explained that pure water may be obtained by sinking the artesian wells through the second lake bottom, and casing the wells to keep out the water from the upper strata.

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[1] Colorado Sta. Bul. 33 (E. S. R., 7, p. 898).

The meteorological records are not reported in detail. They included observations on temperature and pressure, evaporation, rainfall, humidity, sunshine, and solar intensity made at the station, substations, and by voluntary observers at different points in the mountains.

Some notes on draining, H. V. JACKSON (*Agr. Gaz., New South Wales, 8 (1897), No. 12, pp. 881–893, figs. 25*).

Report on trials of farm machinery, U. SVERDRUP (*Tidsskr. Norske Landbr., 5 (1898), No. 1, pp. 5–47, ill.*).—The report gives full descriptions of trials of 7 self-binders and 10 potato harvesters conducted at Aas and Storhamar, Norway, during the fall of 1897, under the direction of the Society for Norway's Weal.

Preliminary results of trials of self-binders at Aas Agricultural College, 1897 (*Tidsskr. Norske Landbr., 4 (1897), No. 10, p. 432*).

Preliminary results of trials with potato harvesters, U. SVERDRUP (*Tidsskr. Norske Landbr., 4 (1897), No. 10, p. 472*).

Repairs of macadam roads, E. G. HARRISON (*U. S. Dept. Agr., Office of Road Inquiry Circ. 30, pp. 14*).—The text of a paper and letters from experienced road builders upon this subject.

Green fodder in winter (*Sächs. Landw. Ztschr., 45 (1897), No. 41, pp. 563–566, figs. 3*).—A description of a press useful in preserving forage crops.

A model cow shed, J. MAHON (*Queensland Agr. Jour., 1 (1897), No. 6, pp. 437, 438, pl. 1*).—Drawings and specifications for a barn to accommodate twenty cows are given.

STATISTICS—MISCELLANEOUS.

Agriculture in Alaska, W. H. EVANS, B. KILLIN, and S. JACKSON (*U. S. Dept. Agr., Office of Experiment Stations Bul. 48, pp. 36, pls. 23*).—This bulletin is the report to Congress of the commission referred to in E. S. R., 9, p. 401. The general features of the investigation are given in that place.

The report gives the general topography and meteorology of the country, including comparative tables which show the average temperature and precipitation of Alaskan, North European, and Canadian stations. The soils of Alaska are discussed at some length and tables are given showing the percentage of coarse and fine earth and the mechanical analyses of 24 samples of soils and subsoils. The natural products of the country are discussed and analyses of the following grasses given: *Phleum pratense*, *Poa pratensis*, *Bromus* sp., *Anthoxanthum odoratum*, *Deschampsia bottnica*, and *Calamagrostis aleutica*. Comparisons are made of these and similar species grown elsewhere. Notes are given on the cultivated products, which consist almost entirely of garden crops. The possible extent of agriculture, as shown by the area of arable lands, is indicated and some of the difficulties and possibilities pointed out. A list of about 100 economic plants and various notes on the native animals and industries are given.

In the preliminary report of Sheldon Jackson brief notes are given on his observations made along the Yukon River as far as Dawson. At various points visited hardy vegetables were seen growing, and grasses taller than a man are reported as growing abundantly.

Tenth Annual Report of Colorado Station, 1897 (*Colorado Sta. Rpt. 1897, pp. 110*).—This contains a financial statement for the fiscal year ending June 30, 1897; the station organization list; inventory of station property; text of the Hatch Act; brief extracts from Circular 29 of the Office of Experiment Stations and from the Report of the Secretary of Agriculture for 1897 (E. S. R., 9, pp. 298, 698); subject list of station Bulletins 1–40; a quite lengthy report by the director, dealing largely with the present status of the station and substations, financially and otherwise, and the interrelationship of the college and station; and short reports by the agriculturist, botanist and horticulturist, chemist, entomologist, meteorologist, and irrigation engineer (see p. 1095), and the superintendents of the substations at Arkansas Valley and Cheyenne Wells. The reports of the substations deal principally with tests of various crops and varieties of fruits, vegetables, etc. A brief note is also given on the use of cornstalks as windbreaks for crop protection.

Ninth Annual Report of Kentucky Station, 1896 (*Kentucky Sta. Rpt. 1896, pp. XLIII, Append. pp. 114*).—Organization list; report of the treasurer for the fiscal year ending June 30, 1896; brief report by the director on the staff, equipment, publications, etc., of the station; reports by the heads of the departments of chemistry, entomology, botany, horticulture, and meteorology, on the work of the year, detailed results being given in some instances (noted elsewhere); reprints of Bulletins 61–65 of the station; and an index to the report and bulletins.

Annual Report of South Carolina Station, 1897 (*South Carolina Sta. Rpt. 1897, pp. 24*).—Includes the organization list of the station, text of the Hatch Act of March 2, 1887, and brief reports by the vice-director and heads of departments on the work of the year, with a list of the bulletins published. In addition to the general work of the chemist, the results of analyses of two samples of Sea Island cotton seed, a summary of the results of fertilizer inspection in the State during 1896 and 1897, and notes and comments on the sanitary examination of a number of artesian well and spring waters are given.

Annual Report of Virginia Station, 1897 (*Virginia Sta. Rpt. 1897, pp. 12*).—This contains the organization list, subject list of bulletins published during the year, treasurer's report for the fiscal year ending June 30, 1897, and short reports on the work of the year by the heads of the different departments. The report of the meteorologist included within these pages is noted on page 1034.

A report on the work and expenditures of the agricultural experiment stations, 1897, A. C. TRUE (*U. S. Dept. Agr., Office of Experiment Stations Bul. 50, pp. 97, figs. 6*).—A critical review of the conduct and general management of the stations, with brief abstracts of all station publications received by the Office of Experiment Stations during the fiscal year ending June 30, 1897; and general statistics of the stations relative to organization, publications, principal lines of work, revenue, etc.

Report of the work during 1896 at the agricultural station of the Island of Mauritius, P. BONÂME (*Ann. Sci. Agron., 1897, II, No. 2–3, pp. 307–358*).

Report of the Royal Society for Norway's Weal for 1896 (*Christiania, 1897, pp. 160*).

Agriculture in Denmark compared with that in Great Britain, H. NATHORST (*Tidskr. Landtmän, 18 (1897), No. 37, pp. 668–673*).

Activities of agricultural associations in the past, present, and future, N. HEYMANN (*Tidsskr. Landökon., 16 (1897), No. 5–6, pp. 417–458*).

Agricultural conditions on the Island of Jersey, J. LARSEN (*Tidsskr. Landökon., 16 (1897), No. 5–6, pp. 479–489*).

Agricultural calendar for 1898, K. K. HEJE (*Lomme-Almanak for Landmänd, Mejerister og Skogbrugere, 1898. Christiania, 1897*).

Land economic associations in Denmark, J. C. LA COUR (*Tidsskr. Landökon, 16 (1897), No. 5–6, pp. 459–478*).

Organization lists of the agricultural experiment stations and institutions with courses in agriculture in the United States (*U. S. Dept. Agr., Office of Experiment Stations Bul. 47, pp. 96*).—In addition a subject list of publications of the experiment stations received by the Office of Experiment Stations during 1897, and the Federal legislation relating to the colleges and stations and the rulings of the Treasury, Post-Office, and Agricultural Departments as to the construction of the act of Congress of March 2, 1887, establishing the stations, are included.

Truth about agricultural depression; an economic study of the evidences of the Royal Commission, F. A. CHANNING (*London: Longmans Green & Co., 1897, pp. 388*).—The author sums up and analyzes the data accumulated by the recent Royal Commission appointed to investigate the causes of agricultural depression in England. The history of the decline of British agriculture, past and present methods of farming, economic relationship of landlords and tenants, etc., are discussed at length. Excessive rents is believed to be the chief cause of the depression.

Agricultural statistics of the province of South Australia, 1896 (*South Australia Stat. Reg., 1897, pt. 3, pp. 83*).—This gives returns showing the total acreage of occupied and cultivated land, acreage of each of the different farm and orchard crops and the produce therefrom, stands of bees and the honey product, number and kinds of live stock, wool production, etc., of each district and county of the Province for the year ending March 31, 1897. The number of mills and manufactories, rates of wages, prices of raw and manufactured product, etc., are also given. In some instances similar data are given for preceding years for comparison.

Statistics of the land-grant colleges and agricultural experiment stations in the United States (*U. S. Dept. Agr., Office of Experiment Stations Bul. 51, pp. 39*).—A summary of the data contained in this bulletin has already appeared (E. S. R., 9, p. 701).

Proceedings of the eleventh annual convention of the Association of American Agricultural Colleges and Experiment Stations, A. C. TRUE and H. H. GOODELL (*U. S. Dept. Agr., Office of Experiment Stations Bul. 49, pp. 100, fig. 1*).—This gives the officers and committees of the Association and the proceedings of the convention held at Minneapolis, Minn., July 13–15, 1897, an account of which has already appeared (E. S. R., 9, p. 303). In addition to the general business and discussions the following papers are included: Evolution of agricultural education, G. T. Fairchild; Advertising in Experiment Station publications, A. C. True; An experiment, its conception and methods of procedure, H. L. Bolley; How may university extension work be best conducted by the colleges of agriculture, I. P. Roberts; Preparatory teaching in agricultural colleges, E. W. Hilgard; Preparatory work in agricultural colleges, W. M. Hays; Science *vs.* art, I. P. Roberts; Methods of keeping records of horticultural work at the State Agricultural Experiment Station, Geneva, N. Y., S. A Beach; The importance of mycophagy in a course on botanical instruction, H. N. Starnes; Classification of varieties of peaches, R. H. Price; Horticultural education in Minnesota, S. B. Green; A bacterial disease of cabbage and allied plants, H. L. Russell; Development of electrical engineering in Utah, J. Jensen; and A calorimetric determination of the heating value of corn, C. R. Richards.

Teaching agriculture and the sciences, O. PAVETTE (*L'enseignement des sciences et de l'agriculture. Paris: Fernand Nathan, 1898, pp. 36*).—A revised edition for the use of instructors.

The new chemical institute of the University of Breslau, SCHOLTZ and KLINGENSTEIN (*Chem. Ztg., 21 (1897), No. 51, pp. 501–503, figs. 3*).

Public laboratory and experiment station in Johannesburg (South African Republic), J. LOEVY (*Chem. Ztg., 21 (1897), No. 69, pp. 677, 678, fig. 1*).—A plan and description of the new building opened in May, 1897.

Report of the chemical and seed control station at Skara, 1896, O. NYLANDER (*Skara (Sweden), 1897, pp. 16*).

On government control of fertilizers, feeding stuffs, and seeds in Sweden (*Landtmannen, 8 (1897), Nos. 18, pp. 243–247; 19, pp. 259–264*).

The chemical plant biological station at Luleå, Sweden (*Landtmannen, 8 (1897), No. 6, pp. 71–76*).

NOTES.

Idaho Station.—The citizens of Moscow have recently donated to the station 10 acres of land additional to the tract already given, making 94 acres in all. The new tract is so situated as to add greatly to the value and convenience of the station farm. Contracts for material have been made for a greenhouse, with work rooms and class room.

Michigan Station.—A. A. Crozier has resigned his position as agriculturist of the station, and J. D. Towar, formerly of the Rhode Island College and Station, has been appointed field agriculturist.

A systematic series of soil examinations begun last year will continue through this season under the supervision of M. W. Fulton, the object being to study the relation of the soil to water.

Montana College and Station.—Robert S. Shaw has been appointed professor of agriculture in the college and assistant agriculturist of the station.

North Carolina Station.—J. D. Hufham, jr., assistant chemist; S. B. Moore, clerk; and L. W. Physioc, mailing clerk, have severed their connection with the station; and the following appointments have been made: Mrs. L. V. Darby, stenographer, and C. M. Hughes, clerk. F. G. Kelly has been changed from clerk to assistant chemist.

South Carolina Station.—J. S. Pickett has been made foreman of the station farm. The station barn, burned by lightning August 5, 1897, has been replaced by a large storage barn for dry fodder, silos, and motive-power machinery; a dairy barn with a capacity for 52 cows; and a general purpose barn, the first floor of which is used for stock and contains an office, milk room, feed bins, etc., and the second floor for general experimental work, with seed rooms, etc. The poultry division has established 36 pens 20 by 36 ft. and 9 runs 80 by 150 ft., all of which is inclosed with the most improved poultry cable and picket wire.

Personal Mention.—Dr. George Henry Horn, born at Philadelphia, April 7, 1840, died at Busleys Point, New Jersey, December 24, 1897. Dr. Horn's works on North American Coleoptera are well known. In his 150 more important contributions to entomology and in minor notes he named 150 new genera and more than 1,550 new species, very few of which are now classed as synonyms.

Dr. Askenasy has become honorary professor of botany at Bonn.

EXPERIMENT STATION RECORD.

Vol. IX. No. 12.

The present number completes the ninth volume of the Record. The character and extent of the work in this and the preceding volume is indicated by the following table:

	Volume VIII.	Volume IX.
Station reports	62	56
Station bulletins	340	317
Publications of United States Department of Agriculture	92	201
Foreign articles	702	842
Total number of articles	1,565	1,810
Classified as follows:		
Chemistry	157	121
Botany	69	86
Fermentation and bacteriology	5	28
Zoology	10	31
Meteorology	54	57
Water and soils	55	72
Fertilizers	103	85
Field crops	228	153
Horticulture	154	138
Forestry	11	16
Seeds and weeds	29	41
Diseases of plants	79	107
Entomology	126	252
Foods and animal production	177	186
Dairy farming and dairying	139	151
Veterinary science	51	134
Technology	4	11
Agricultural engineering	22	38
Statistics	92	103

The abstracts in this volume occupy 770 pages, and required in their preparation the reviewing of 56,569 pages in the original publications. In addition to this the volume contains 2,471 titles (mostly foreign), not abstracted; 14 editorials, occupying 30 pages; 8 special articles, occupying 136 pages, and 93 station notes, occupying 11 pages.

As in previous volumes the subject-index has been made in sufficient detail to serve as a fairly complete guide to the contents of the publications abstracted.

The review of the literature of agricultural science made in this volume of the Record is more complete than heretofore. Especial attention has been given of late to extending the range of the abstracts in a number of subjects, and especially in veterinary science. The Russian and Italian reports of agricultural investigations have also been more thoroughly reviewed. The task of collecting and abstracting the books, periodicals, and miscellaneous publications in which the records of agricultural science are printed becomes larger and more difficult each year. While we have received much assistance from publishers and authors in our efforts to secure material for the Record, we still need the further cooperation of our readers, especially to bring to our attention articles which are first published in out of the way places. It is recognized that the Record might well be developed in the direction of adding at least brief abstracts to all the titles recorded. Our present force of workers will permit little, if any, expansion in the amount of matter prepared for publication. It is a fact to be deplored that from time to time long articles of much importance are passed over with only a brief notice because of the time required to make a satisfactory review of them. We are, however, encouraged by the increasing testimony regarding the value of a comprehensive review of the current literature of agricultural science to make renewed efforts to make our work in this line still more complete and satisfactory.

INDEX OF NAMES.

INDEX OF SUBJECTS.