U. S. DEPARTMENT OF AGRICULTURE.

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Experiment Station Work, LX.

Compiled from the Publications of the Agricultural Experiment Stations.

COMMERCIAL BEAN GROWING.
DIGESTION EXPERIMENTS WITH RANGE FORAGE CROPS.
STALLION LEGISLATION.
SUBSTITUTES FOR OATS FOR HORSES.
TESTS FOR CASEIN IN MILK.

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EXPERIMENT STATION WORK.

Edited by W. H. Beal and the Staff of Experiment Station Record.

Experiment Station Work is a subseries of brief popular bulletins compiled from the published reports of the agricultural experiment stations and kindred institutions in this and other countries. The chief object of these publications is to disseminate throughout the country information regarding experiments at the different experiment stations, and thus to acquaint farmers in a general way with the progress of agricultural investigation on its practical side. The results herein reported should for the most part be regarded as tentative and suggestive rather than conclusive. Further experiments may modify them, and experience alone can show how far they will be useful in actual practice. The work of the stations must not be depended upon to produce "rules for farming." How to apply the results of experiments to his own conditions will ever remain the problem of the individual farmer.—A. C. True, Director, Office of Experiment Stations.

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ILLUSTRATIONS.

EXPERIMENT STATION WORK.[a]

COMMERCIAL BEAN GROWING.[b]

The bean, *Phaseolus vulgaris*, has long furnished a favorite food for many races of mankind. It is too valuable for this purpose to be used extensively as a food for animals, but the straw, pods, and the culls rejected with gravel and trash in cleaning the crop for human food are used to balance the rations of various farm animals. As they usually command a good price, beans are especially valuable as a money crop, which can be grown on small or large areas as circumstances demand.

Although beans will grow well on almost any land that will produce the principal cereal crops, they are especially useful in utilizing and improving thin land. They prefer a heavy clay loam that is well drained. The most desirable soils for beans are clay loams or soils overlying limestone. Gravelly soil may be used if the gravel is not too coarse, but muck soils or soils very rich in humus are likely to produce too much vine and too little seed. Low, wet, or poorly drained soils can not be expected to give good results. A 25-bushel crop of beans contains about 56.2 pounds of nitrogen, 13.5 pounds of phosphoric acid, and 22 pounds of potash, but as the nitrogen is largely obtained from the air the crop is not an exhausting one to the land.

It is impossible to tell which of the many varieties of beans will prove best for a given locality until a careful test has been made. The Choice Navy variety matured about September 17 at the Virginia Station, and produced the highest average yield, 22.5 bushels. The average yields of straw per acre in the same test of nine varieties ranged from 0.3 to 0.85 ton per acre. It is sometimes thought that the kidney beans thrive on heavier and stronger soils than those best adapted to the smaller white beans. Tests made in New York

[a] A progress record of experimental inquiries, published without assumption of responsibility by the Department for the correctness of the facts and conclusions reported by the stations.

[b] Compiled from Michigan Sta. Bul. 359; New York Cornell. Sta. Bul. 210; Virginia Sta. Bul. 168, p. 282. For further information on the production and use of beans see U. S. Dept. Agr., Farmers' Buls. 78, p. 27; 169, p. 26.

fail to verify this view, but indicated that there was a great difference of productivity of the different varieties of beans on any given soil. No regularity of results was observed which justified the restriction of plantings on any given soil to any type of bean. The principal varieties grown in New York are the Pea beans, the Mediums, the Red Kidney, and the White Marrows, while the five leading varieties grown in Michigan are the Pea, Medium, Red Kidney, White Kidney, and Black Turtle Soup. One experienced grower, quoted in a Michigan bulletin, prefers the little, old-fashioned pea bean as a money crop.

Beans produce best on an inverted clover sod, and in New York are usually given this position in a clover, bean, wheat rotation. Where corn and potatoes are grown they are sometimes given a part of a clover sod and followed by beans, making the rotation one of four years. Where the bean crop is to be followed by wheat the pea and medium varieties are preferred, because their earlier maturity permits their removal from the land early enough for thorough preparation for wheat. The larger varieties that hold the land longer may be followed by corn or potatoes. In Michigan, a similar 3-year rotation is followed, but it is suggested that some alsike and timothy be mixed with the clover that the hay crop may be followed by pasture, thus giving a different 4-year rotation especially suited to Michigan conditions.

As the bean crop is not planted until late in the spring the preparation of the soil is often delayed, but early plowing is essential to the best results. After plowing, the land should receive frequent cultivation for five or six weeks to put it into the best possible tilth, kill weeds, and conserve moisture, especially as the crop should not be deeply cultivated later.

If beans are grown on light, sandy soils or others lacking in fertility, it will be well to top-dress with fine or well-rotted manure, after plowing, at the rate of 6 to 8 loads per acre, or even more than this if a manure spreader is not used. This may be supplemented by commercial fertilizers, supplying from 15 to 20 pounds of muriate of potash and 20 to 30 pounds of phosphoric acid per acre, mixed with the manure as it is scattered. Tests of fertilizers made by New York farmers gave exceedingly variable results and indicated that there was danger that the stand might be injured by fertilizers. This was especially true of potash, and in dry seasons sufficient moisture should be present to dissolve the plant food if benefit rather than injury is to result.

As beans are legumes, the best results can be obtained from them only when nodule-producing organisms are present in the soil or are introduced by the application of soil from fields that have already

grown successful bean crops. Inoculation with pure cultures has given variable results. In a Virginia experiment the results failed to indicate a marked benefit from such inoculation.

Early planting of beans is likely to result in the rotting of the seed as they are placed in cold or wet soil. Even if germination should be successful and the stand good, it is likely to be uneven, and the stronger plants will ripen earlier and render successful harvesting more difficult. In New York the Kidney and Black Turtle Soup varieties should be planted during the last two weeks of May, the Pea and Medium varieties from June 5 to 20, and the Marrows and Yellow Eyes intermediate to these two groups. In Michigan, the time of planting ranges from June 1 to 25. In general, the Kidney and Turtle Soup and other larger varieties should be planted earlier than the Pea varieties.

Only the best hand-picked beans should be used for planting, as a strong and even germination is essential to the success of the crop. The vitality of the seed may well be tested by the use of the ordinary germination test.[a] It is better to plant about 4 inches apart in drills than in hills or checks. The smaller varieties may be successfully planted in ordinary grain drills of which part of the spouts have been removed or stopped, but in planting the larger varieties a special bean drill should be used, unless one of the grain drills with proper attachment for handling these larger seeds is available. In any case shallow planting will give the best results, and evenness of germination will be more likely to result if the drill wheel presses the soil closely about the seed. The rate of seeding varies from one-half or three-fourths bushel for the smaller varieties to 1 or 1½ bushels per acre for the larger varieties, such as the Red Kidney bean.

Much of the work of cultivation has already been accomplished if the seed bed has been thoroughly prepared. Under proper soil conditions the seed comes up very quickly and cultivation may begin early, but the young plants are tender and break so easily that they must be carefully worked. One and 2 row wheel cultivators are largely used as well as the implements of other designs. The bean requires the culture usually given to other intertilled crops. A crust should not be allowed to form, but later cultivation should not be deep, especially during drought, because the rootlets of the plant grow near the surface. The plants should not be worked while wet with dew or rain, because of the danger of spreading the anthracnose disease.[b]

[a] Directions for making such a test with corn may be found in U. S. Dept. Agr., Farmers' Bul. 229, p. 19.

[b] For further information on bean anthracnose see U. S. Dept. Agr., Farmers' Bul. 388, p. 21.

The work of harvesting the bean crop has been much lightened by the 2-wheeled implement shown in figure 1. The long steel blades should be so adjusted as to remain from 1½ to 2 inches beneath the soil surface throughout their length. Two rows are thus cut at the same time and thrown into a single windrow. After drying a day these rows may be moved by forks in such a way as to combine three of them and leave space for the wagons into which they are to be loaded to pass through. With suitable weather conditions the crop may be hauled to the barn without further turning, but if wet weather follows the crop will not be seriously injured if turned often enough to prevent any pods from resting on the wet ground long

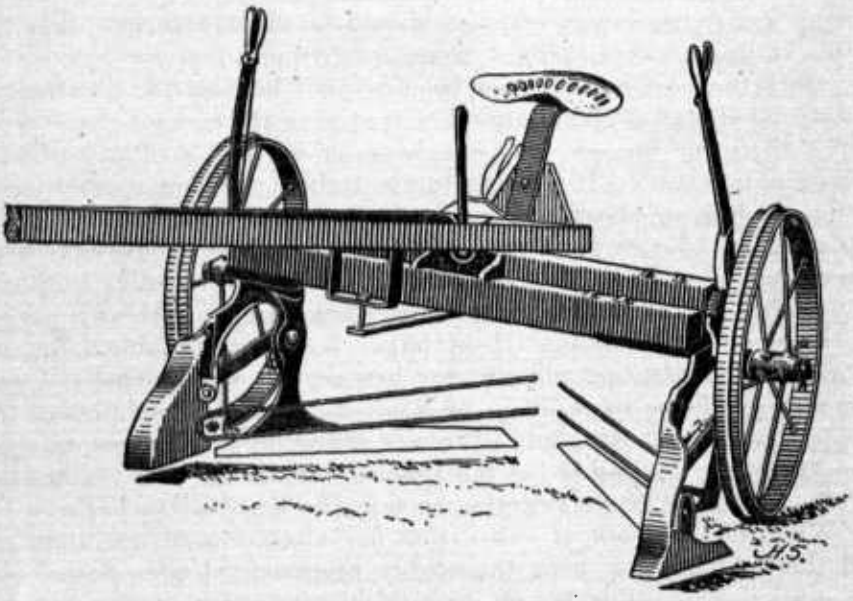

FIG. 1.—Modern bean harvester.

enough at a time to swell and burst. The side-delivery rake is sometimes used, but on any but light soils it is likely to mix so much dirt and gravel with the beans that they can not be separated in threshing.

Threshing is usually done by special machines called "beaners," which go from farm to farm for hire as do ordinary grain threshers. These beaners sometimes split so many beans that the old-fashioned flail is regarded more economical in spite of its slowness.

The crop is usually taken to the bean houses or elevators as soon as threshed for cleaning, grading, and picking. A sample is weighed, picked, and weighed again to determine the loss by picking, and settlement made on the basis of the estimated amount of picked beans

which the farmer delivers. The beans are graded according to size and hand picked by women and girls as they pass through special machines which remove much of the refuse and carry the beans before the operator on a movable canvas apron from which the gravel and damaged beans may easily be removed. The culls may be used as food for sheep, cattle, swine,[a] and other animals.

DIGESTION EXPERIMENTS WITH RANGE FORAGE CROPS.[b]

In a previous number of this series[c] experiments are reported on the nutritive value of native hays in the arid regions. In those experiments the dried fodder was used which, in most cases, consisted of a mixture of different species. The Nevada Station recently completed some digestion experiments with sheep, in which different species of forage plants of the range were gathered and fed separately in the green state. Many of these succulent plants and shrubs, especially the flowers, are preferred by the sheep to the grasses. Before advocating any method for restoring the depleted sheep ranges, both the palatability and nutritive value of each species should be known in order to obtain the optimum return in the production of wool and mutton. Many forage plants are known to be well liked by the sheep, though no accurate data regarding their nutritive value have hitherto been undertaken. There are other plants which the sheep eat that are not particularly palatable to them, but at the same time they may be more highly nutritious than those which the sheep eat with avidity. It was with the object of determining both the palatability and nutritive value that the investigations at the Nevada Station were undertaken with a few of the more important forage plants on the ranges in the vicinity of Reno. In order to carry on the experiments under as nearly natural conditions as possible, the plants were gathered fresh and fed directly on the range.

INDIAN POTATO (*Atænia gairdneri*).

The Indian potato is one of the most abundant and best liked forage plants on the range. Although belonging to the parsnip family it does not have any objectionable features like its relation, the poisonous wild parsnip. Its tuberous root has been an important article of food for the Indian tribes, as it contains much starch and has a sweet and pleasant taste.

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[a] See article on cull beans for hogs, U. S. Dept. Agr., Farmers' Bul. 305, p. 25.

[b] Compiled from Nevada Sta. Bul. 71.

[c] U. S. Dept. Agr., Farmers' Bul. 374, p. 344.

SUNFLOWER (*Wyethia mollis*).

This sunflower is relied upon for a considerable portion of the feed on the ranges. During the average season each plant produces from 15 to 20 heads of yellow flowers. The sheep are so fond of the flowers that until they are all eaten off they pay little or no attention to the leaves. On account of the dense, woolly character of the leaves the sheep usually avoid the older ones and eat out the younger ones from the center of the clump. Its strong roots make it a valuable plant, as the ranges are severely grazed. From a forage standpoint it is not relished by stock like the balsam root sunflower. Unfortunately, in this experiment the flowers were not included, as the buds were destroyed by a heavy frost.

BALSAM ROOT OR BIG SUNFLOWER (*Balsamorrhiza sagittata*).

The big sunflower is a more valuable forage plant than the common sunflower, as it is liked by stock not only in its green state but in the late fall when the leaves have dried. Cattle, sheep, and horses will eat it with considerable relish. The strong perennial character of its roots also prevent it from being easily tramped out. The flowers are eaten with the same avidity as the common sunflower, from which it can be distinguished by the long flower stems which generally exceed the length of the leaves, and by the ear-like lobes at the base of the leaves. The flowers in this experiment were not included as they were frozen.

WILD CARROT (*Leptotænia multifida*).

The wild carrot belongs to the parsnip family and has a long conical root. The finely divided leaves are produced in abundance at the base, while the yellowish-brown flowers are borne on stout stems about 2 feet high. Although it has a peculiar odor the sheep seem to be very fond of the plant, which occurs over a very wide area of the State and may be considered one of the chief forage plants for sheep on the ranges. The plant as fed included the flowers, stems, leaves, and partly ripened seeds. It has been suggested by some sheepmen that the roots of this plant may be poisonous. No experiments have been made to determine this point.

MOUNTAIN INDIAN PINK OR PAINTED CUP (*Castilleia miniata* var.).

The Indian pink is important as a forage plant because of its abundance. The plants are always eaten down to the ground, but on account of the strong underground rootstocks they are able to withstand considerable tramping. The particular species fed grows in clumps of 4 or 5 feet in extent, and it is best when partly shaded by tall shrubs. It was fed when in full flower.

WESTERN BROME GRASS (*Bromus marginatus*).

This is one of the best range grasses of the West, extending to Montana and Wyoming. It has been favorably mentioned by nearly all of the western experiment stations, but as yet the seed is not sold on the market. It was found in feeding this plant that at first the sheep appeared to be looking for a succulent plant like most of the others, but when they once started to eat it a comparatively small amount of the grass seemed to satisfy them.

NATIVE BLUE GRASS (*Poa sandbergii*).

This grass is one of those commonly included under the term "bunch grass," which term includes most of the blue grasses as well as a number of the needle grasses and fescues. This particular species was growing thickly in gravelly soil, on steep hillsides in open spaces, and was considerably past the flowering stage when fed. Consequently it might be considered more as hay than as green fodder. A comparatively small amount of the grass at this stage of its growth seemed to satisfy the sheep.

WILD DANDELION (*Crepis intermedia*).

This is one of the several kinds of wild dandelions found on the range of which the sheep appear to be fond, although they contain a bitter principle. The view is advanced that the sheep may eat the dandelion as a tonic to enable them to better assimilate some of the other plants. Although the sheep ate this plant well, yet the results of the experiments indicate that it was not readily digested. A large amount of this plant would be necessary to maintain the animal in good condition.

BITTER BRUSH (*Kunzia tridentata*).

This common shrub of the foothills is sometimes included with other shrubs under the term "buck brush." The leaves are persistent throughout the winter, which makes it a very valuable winter forage. Unlike the wild dandelion, its bitter principle seems to prevent its being eaten readily during the summer. Although the new and more tender parts of the shrub were selected for the feeding experiment, yet it was with difficulty that the sheep could be induced to eat a sufficient quantity to conduct the experiment, which was accordingly shortened to 4 days. The plant is eaten readily in the late fall or winter season.

LITTLE LUPINE (*Lupinus* sp.).

An unknown species of lupine was fed when in full bloom and was well liked by the sheep.

BITTER VETCH (*Lathyrus coriaceus*).

Before the sheep would touch this plant they had to be partially starved, and it seemed to have a poisonous effect, as their heads began to swell and they lost considerably in weight. On this account the experiment was continued for 3 days only. By feeding the sick sheep with native blue grass they were soon brought into good condition.

For convenience of comparison and reference, the results of digestion experiments with the various forage plants are collected in the following table:

Digestible nutrients in 100 pounds of green forage.

Sample.	Amount eaten per day.	Protein.	Fat.	Nitrogen-free extract.	Nutritive ratio.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	
Indian potato	32.50	3.88	3.73	49.59	1:15
Common sunflower	52.56	11.50	2.46	38.32	1:3.8
Balsam root or big sunflower	33.00	12.15	4.26	37.43	1:3.9
Wild carrot	50.25	6.88	5.73	50.17	1:9.2
Mountain Indian pink	28.50	6.27	3.47	47.59	1:8.9
Western brome grass	24.00	5.91	1.59	46.36	1:8.5
Native blue grass	15.00	5.15	1.43	41.35	1:8.7
Wild dandelion	34.00	5.11	1.05	46.35	1:9.5
Bitter brush	8.50	9.72	2.25	62.50	1:6.9
Little lupine	32.50	9.06	1.70	34.61	1:4.2
Bitter vetch	14.75	4.47	1.30	39.00	1:9.4

STALLION LEGISLATION IN THE UNITED STATES.[a]

In a previous number of this series attention was called to the importance of giving more attention to the selection of breeding stock, and a brief account was submitted of the work of the Department of Agriculture and the national aid rendered in European countries toward improvement in the horse breeding. It is the purpose of this article to note some of the principal features of recent legislation in several States relating to the registration and control of stallions, in order to prevent fraud and to eliminate the unfit.

WISCONSIN.

Wisconsin under the influence of the department of horse breeding at the station was the first State to pass a stallion law. Under this law, which went into effect January 1, 1906, and since amended, all stallions with contagious or hereditary diseases are excluded from service. The first step toward the improvement of horse breeding is the elimination of unsoundness. This Wisconsin has accomplished by not enacting an extreme measure at the start. Discussing this law, Dr. A. S. Alexander, of the Wisconsin Station, says:

[a] Compiled from Wisconsin Sta. Buls. 141, 155, 169, 186, 188; U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1908, p. 335.

Too stringent measures can not safely be thrust upon the people without due warning, preparation, and education; hence the recently enacted stallion law started by giving owners the privilego of either making affidavit to the soundness of their horses or employing a graduato veterinarian to make a critical examination and sign a certificate of soundness. It was not thought that this plan would prove perfect, but it was expected that at least it would draw attention to important matters pertaining to the soundness of breeding animals, sift out some of the unsound sires, teach the equal need of using sound brood mares and, in timo, lead to more stringent and effectual methods of examination and rejection of unsound stallions. That the law has had these effects there can be no question, for we have abundant evidence that it already has retired upwards of 100 unsound or unsuitable stallions from public service, led men to inquire as to what diseases constitute hereditary, transmissible, or communicable unsoundness, and pay more attention to the matter of soundness in brood mares.

As the law required owners of pure-bred stallions to submit the certificates of registry of their horses for inspection before license certificates could be granted, it has led to more care being taken in all matters pertaining to the recording of pedigrees, the character of pedigree registry studbook societies, associations, and companies, the correctness of pedigree certificates and the proof of identity in the case of aged horses that have changed hands many times. Then, too, it has caused discussion in every blacksmith shop, livery stable, farm barn, and country assembling place relative to the importance of pedigree, the power and prepotency of pure blood, the foolishness of breeding to horses of mixed breeding, or of no known breeding, the fallacy of using horses of poor individual quality and character, and tho importance of knowing exactly what is tho true breeding of each stallion standing for public service throughout the State.

The effect of the new law has been to arouse owners to due appreciation of the need of registry certificates, and after considerable trouble in completing their records and establishing identity they have obtained certificates of registry from the studbook societies. The number of the certificates issued to trotting horses is greatly in excess of those issued to other breeds, but the law has had a good effect in causing breeders to attend more strictly and promptly to all matters pertaining to the recording of their horses.

The State's attorney-general has given it as his opinion that fees can not legally be collected for the service of any stallion or jack that is not licensed and advertised in accordance with the requirements of this law. The purpose of the law is to plainly and correctly inform the owner of mares as to the breeding of each stallion offered for public service. It further advises him that the horse in question has been proved by sworn statement of either the owner or a legally qualified veterinarian to be free from hereditary, contagious, or transmissible unsoundness or disease.

The license certificates issued under tho provisions of this law are of five kinds, viz: (1) Pure bred: The stallions and jacks granted this form of certificate are registered in studbooks recognized by the Department of Agriculture, Washington, D. C. It is also given to stallions recorded as standard bred in the American Trotting Register and to those recorded in the Morgan Horse Register. Only pure-bred stallions can sire grade horses. Horses sired by stallions other than pure bred are not grades, but mongrels or scrubs. (2) Cross bred: This certificate is given to any stallion that has a pure-bred, registered sire of one breed and a pure-bred registered dam of a different breed. Such stallions are not registered or eligible to register in any studbook recognized by the Department of Agriculture, Washington, D. C. A cross-bred stallion can not be depended upon to transmit with certainty the characteristics or qualities of either of his parents. Only seven "cross-bred" licenses have thus far been issued.

(3) Nonstandard bred: This certificate is given to stallions recorded as nonstandard bred in the American Trotting Register, and such horses are not pure bred and are not eligiblo to registry as standard bred. Only 14 certificates of this kind have been issued. (4) Grade: This certificate is now given to stallions proved to be by pure-bred sires or out of pure-bred dams. Under the provision of tho original law stallions noither of whose parents were puro bred wero licensed as "grades." Under the amended law, approved June 9, 1909, and now in force, stallions whose sires or dams can not be shown to have been pure bred will not be licensed as "grades" or granted renewal of licenses as "grades." Under the head of "grade" also are licensed jacks not registered or eligible to registry in jack registry books recognized by the Department of Agriculture, Washington, D. C. Theso animals, however, strictly speaking, can not be regarded as "grades" although unregistered. Grade stallions can not sire grade colts unless thoy happen to be bred to pure-bred mares, and that seldom, if ever, happens. Even where they are mated with pure-bred mares the progeny in reality are not "grades" but mongrels, for such breeding is "degrading" rather than "grading up." Tho progeny by grade stallions from mares other than pure bred are mongrels and scrubs. Any colt by a grade stallion retained for breeding purposes will have to be licensed as mongrel or scrub. (5) Mongrel or scrub: The amended stallion law approved June 9, 1909, provides this new license certificate for stallions neither of whose parents were pure bred. It will also be given to any stallion hitherto licensed as a "grade" if, when applying for a renewal of license, the owner can not prove purity of breeding for either the sire or the dam of his horse.

The following statements regarding stallion legislation in various States are taken mainly from Doctor Alexander's reviews in bulletins of the Wisconsin Station.[a]

IOWA.

Iowa followed the lead of Wisconsin by enacting, April 10, 1906, a law regulating the registration and publication of pedigrees.

The original law was repealed March 30, 1907, and a new law substituted which provides that any owner or keeper of any stallion kept for public service, exchange, or transfer, who represents such stallion to be pure bred shall cause the same to be registered in a studbook recognized by the Department of Agriculture, Washington, D. C., forward the same to the secretary of the Iowa State Board of Agriculture, who shall verify the registry certificate, enroll it upon his books, and issue a certificate giving a description, etc., of tho stallion and the volume and page of the studbook in which he is registered. * * * The Iowa stallion law does not require a stallion license fee from the owner of a scrub or grade stallion, does not include jacks, and does not require either the owner's affidavit or a veterinarian's certificate relative to the soundness of the stallion. According to assessors' reports there are 6,079 stallions in Iowa. To date licenses have been issued to 3,741 pure-bred stallions.

MINNESOTA.

A law for the regulation of the public service of stallions in Minnesota was enacted by the legislature of that State and approved April 25, 1907. Under its provisions 589 pure-bred stallions and 889 grade stallions have been licensed from June 1 to October 10, and the papers of about 100 stallions were at the latter date under consideration. The Minnesota law [passed 1907] creates a stallion registration board,

[a] A similar summary will be found in the report of the Bureau of Animal Industry of this Department for 1908.

the officers of which shall be ex officio the professor of animal husbandry of the Minnesota College of Agriculture, who shall be ex officio secretary and executive officer of the board, the veterinarian of the state expeirment station, and the president of the Minnesota Horse Breeders' Association. All owners of stallions used for public service in the State must obtain licenses from this board, the enrollment and verification of pedigrees to be done in the division of animal husbandry of the College of Agriculture of the University of Minnesota. All licenses must be recorded with the register of deeds of the county or counties in which the stallion is used for public service. * * * The presence of any one or more of the following-named diseases shall disqualify a stallion from public service, and are hereby defined as infectious, contagious, or transmissible disease or unsoundness for the purposes of this act: Cataract, amaurosis, laryngeal hemiplegia (roaring or whistling), chorea (St. Vitus's dance, crampiness, shivering, stringhalt), bone spavin, ringbone, sidebone, glanders, farcy, maladie du coït, urethral gleet, mange, melanosis and curb when accompanied by curby-formed hock.

COLORADO, NEBRASKA, AND PENNSYLVANIA.

In Colorado and Nebraska stallion laws are now in force similar to the Iowa law. The stallion law of Pennsylvania, which became effective January, 1908, is similar to the Wisconsin law and places the work of stallion enrollment in the hands of the state live stock sanitary board.

The board is authorized to establish needful regulations, and to provide for official examination upon voluntary requests from owners of stallions, and to issue certificates of approval for stallions that are approved in respect to purity of breeding, soundness, conformation, breod type, and their suitability to improve the horse stock of the State.

UTAH.

A similar law to that in force in Wisconsin was approved March 23, 1907, by the governor of Utah and went into effect May 13, 1907. It creates a state board of horse commissioners, consisting of the veterinarian and animal husbandman of the Agricultural College of Utah, who shall pass upon all documents pertaining to stallion registration, examine as to the merits of pedigrees, record and issue certificates for purebred or grade public-service stallions in form practically the samo as that of the like certificates used in Wisconsin. * * * A special feature of the Utah law is that licenso certificates for grade stallions will be good only until January 1, 1909, nothing being said as to reissuing such licenses, which we presume may be taken to mean that grades, after the date mentioned, will not be granted licenses by tho Utah board. The law also provides that every person complying with the provisions of the act shall have a lien on tho mare and a first lien upon tho offspring of such service to the amount of the agreed service fee, for the period of eighteen months after service, and it shall not be necessary in order to secure and fix said lien to secure, file, or register any contract or statement thereof with any officer, nor shall it be necessary that the owner of such mare or foal execute any contract whatever; the said lien may bo foreclosed in the same manner that a mortgage upon personal property is foreclosed.

NEW JERSEY.

The New Jersey legislature of 1907–8 passed a stallion law based upon that of Wisconsin, but having the following important differences, which are pointed out by Doctor Alexander:

The work of stallion enrollment is to be done by a stallion registration board, consisting of the animal husbandman of the state experiment station, who shall be secretary and executive officer, a graduate veterinarian, and a prominent breeder of live stock. "It shall be the duty of the board to examine personally each stallion or jack and determine to the best of their knowledge and belief whether said stallion or jack is free from infectious, contagious, or transmissible diseases or unsoundness, and their findings shall be final." The board is authorized in case of emergency to name a committee in each county, consisting of a graduate veterinarian and a practical horseman who shall examine the various stallions or jacks in the said county as to soundness. The fee for enrollment is $5, and $2 shall be paid annually for the renewal of pedigree certificate and service license. Stallions shall be examined every year until 10 years of age, and after the first examination shall be exempt if 10 years of age or over. The act went into effect September 1, 1908.

The legislature of New Jersey also enacted in 1908 a unique and important bill which now is in force and provides for the appointment of a live-stock commission by the governor, consisting of the director of the state experiment station and the master of the state grange, ex-officio, the animal husbandman of the state experiment station, who shall be secretary and executive officer of the commission, a graduate veterinarian, and a prominent breeder of live stock. "It shall be the duty of this commission, first, to purchase and maintain stallions of draft and coach type for distribution and use in the several counties of the State wherever breeders' associations have been duly organized and which provide dams for breeding, which shall conform to the standards and rules established by the commission; second, to aid in the selection and distribution of breeding sires and dams of other classes of live stock; and third, to constitute a stallion examining board." The sum of $20,000 is appropriated to the commission for the current year, and thereafter $5,000 annually for the purpose of carrying out the provisions of the act.

After visiting many horse-breeding centers in Europe the commission purchased 8 Percherons, 3 Clydesdales, 1 hackney, and 1 heavy harness horse to be loaned to farmers' and breeders' associations.

ILLINOIS.

The Illinois law enacted last winter and to take effect January 1, 1910, requires each stallion owner to obtain a license certificate from the stallion registration board composed of five members, consisting of the secretary of the Illinois state board of agriculture, who shall be ex-officio secretary and executive officer of the board, the state veterinarian, the president and secretary of the Illinois Horse Breeders' Association, and the president of the Illinois farmers' institutes. The fee for a license is $2, and it must be renewed annually at a cost of $1. License certificates are given to "pure-bred" "cross-bred," and "grade" stallions. Requirements for obtaining a certificate are practically the same as in Wisconsin, but the affidavit of soundness must be signed by a veterinarian.

Only the following diseases are specified as disqualifying a stallion from service: Periodic ophthalmia (moon blindness), bone spavin, ringbone, bog spavin, curb when accompanied with curby formation of hock, or any contagious or infectious disease. It will be noted that the Illinois law does not mention the following diseases as dis-

qualifying a stallion from service: Cataract, side bone, whistling, roaring, heaves or broken wind, chorea, shivering, crampiness or string-halt, or navicular diseases. In emergency cases the owner may temporarily make affidavit to the soundness of his horse until convenient to have the animal examined by a veterinarian.

KANSAS.

In Kansas the new law will be enforced by the state live stock registry board, consisting of the dean, veterinarian, and animal husbandman of the Kansas State Agricultural College. "Pure-bred," "cross-bred," and "grade" stallions will be licensed. The fee for a license is $2. Veterinarians only can certify to soundness of stallions. Copies of the license certificates must be posted. The diseases disqualifying a stallion from service are not specified in the law.

MONTANA.

The Montana law enacted in 1909 and now in force provides for a stallion registration board composed of the president of the Montana Horse Breeders' Association, the state veterinarian, and the professor of animal husbandry of the experiment station. License certificates are issued to "pure-bred," "cross-bred," and "grade" stallions. Veterinary inspection is required, but owners' affidavits of soundness will be temporarily accepted until the animal can be examined by a veterinarian. The list of diseases specified as infectious, contagious, or transmissible is copied after that of the Wisconsin law, but omits moon blindness, heaves, and navicular diseases.

A new feature of such legislation is that every person, firm, or company importing any stallion or jack into the State of Montana, for breeding purposes, shall first secure a certificate from a recognized state or federal veterinary officer, certifying that the animal is free from any or all diseases or unsoundness referred to in the stallion law. The certificate must be forwarded to the stallion registration board at least ten days before the importation of the animal into the State.

NORTH DAKOTA.

The North Dakota law will take effect January 1, 1910, and its enforcement will be in charge of a registration board composed of the professor of animal husbandry of the state agricultural college, who shall be secretary and executive officer; the professor of veterinary science of the state agricultural college; the commissioner of agriculture and labor; the president of the live stock sanitary board; and the president of the North Dakota Live Stock Association. Veterinary examination is required and the list of diseases from the Wisconsin law has been adopted with the exception that ringbone, bog spavin, and navicular disease have been omitted. Temporary licenses may be granted on the owner's affidavit of soundness. The license fee is $2 and the annual renewal fee is $1. The fee for veterinary examination is $5. Stallions shall be examined every three years until 10 years old Compliance with the requirements of this law carries with it a lien on the colts of the licensed stallions for service fees.

SOUTH DAKOTA.

The South Dakota law is practically the same as that of North Dakota.

OREGON.

The Oregon law is modeled after the Wisconsin law, except the stallion owner is not required to procure a license certificate for each stallion or jack unless he so desires.

IDAHO.

The Idaho law, which became effective March 15, 1909, has some of the features of several stallion laws of other States. Any person, firm, or company offering a stallion or jack for sale must procure a license certificate in the same manner as if the animal were to be used for public service. The veterinary examination is made by the state veterinarian or one of his assistants, and his report is sent to the live stock sanitary board. This report shall contain a full description of the animal examined, and shall be made in triplicate, one copy being sent to the state live stock sanitary board, one furnished to the owner, and the other retained in the book.

EFFECT OF STALLION LEGISLATION.

Reviewing the progress and effect of stallion legislation in the United States, R. A. Cave, of the Bureau of Animal Industry of this Department, says:

That the state stallion laws mark a distinct step in advance in our horse-breeding industry is hardly to be questioned. One of the first results of the operation of these laws was to provide data which show the actual facts with regard to the stallions being used for breeding purposes.

Other important beneficial results to which Mr. Cave calls attention are the rapid elimination of unfit animals and greater care with regard to breeding and registration.

SUBSTITUTES FOR OATS IN RATIONS FOR HORSES.[a]

The substitution of cheaper feeds for oats for work horses has been studied at the Ohio and Michigan stations, and the results have been noted in previous bulletins of this series.[b]

W. J. Kennedy, E. T. Robbins, and H. H. Kildee, of the Iowa Station, report the results of some experiments along the same line. The feeds used were corn, oil meal, cotton-seed meal, and gluten feed.

The first experiment covered one hundred days in the summer of 1907. Three teams of horses were included. One horse of each team had a ration of corn and oats in equal parts and his mate had a ration of corn and oil meal in the proportion of 15 to 1 by weight and with practically the same nutritive ratio as the corn and oats ration. The hay used was for the most part timothy, occasionally having as much as 25 per cent clover.

The horses were used for teaming and field work practically similar to ordinary farm conditions. After five weeks the amount of protein in the ration was increased. In the case of the corn and oil meal the proportion was then 10 parts corn to 1 part oil meal. This proved too laxative, so some oats were added, and the ration for the balance of the period was corn 12 parts, oats 4 parts, and oil meal 1 part by weight. The results with the last combination were excellent and

[a] Compiled from Iowa Sta. Bul. 109.

[b] U. S. Dept. Agr., Farmers' Buls. 374, p. 16; 384, p. 11.

in general indicated that corn and oil meal maintained weight as well as corn and oats.

The second experiment was a comparison of oil meal and gluten feed and continued ninety-one days. Corn and gluten feed were fed in the proportion of 8 parts to 1, and the corn and oil meal 15 to 1 by weight. It was found that the gluten feed was not relished by the horses and so was not as valuable a supplementary feed as the oil meal, though otherwise satisfactory. The work was light during the second and third experiments.

The third experiment was begun in the latter part of the winter of 1907–8, but was cut short at the end of thirty-five days by the sale of some of the horses. The experiment was resumed May 11, 1908, and continued one hundred and fifty-four days. In this experiment cotton-seed meal was compared with oil meal as a supplement to oats and corn. The oats and corn were ground. Every 100 pounds of grain fed contained 79 pounds of corn, 15 pounds of oats, and 6 pounds of cotton-seed meal for one lot, and for the other 77 pounds of corn, 15 pounds of oats, and 8 pounds of oil meal. During the latter half of the time the proportion of oats was increased about one-third.

The more important parts brought out in these experiments were:

1. The health, spirit, and endurance of work horses were the same when fed corn with a moderate amount of oil meal, or gluten feed, or cotton-seed meal as when fed a corn and oats ration supplying a similar nutritive ratio.

2. The ration of corn and oil meal maintained the weight, flesh, and appearance of the horses fully as well and with less expense than the one of similar nutritive value composed of corn and oats.

3. With corn at 50 cents a bushel, oats at 40 cents, and oil meal at $32 per ton, the average saving in the daily expense of feed for each work day amounted to 1.6 cents by the use of oil meal in the place of oats.

4. A brief trial of ninety-one days with gluten feed indicated that while it was capable of giving good results the ration containing it was not as palatable as the oil-meal ration and cost a trifle more per pound when gluten feed was worth $28 a ton.

5. Cotton-seed meal gave somewhat better results on the whole than oil meal. The ration containing it was fully as palatable and as efficient in maintaining the health and weight of the horses, it was less laxative, and a little cheaper with cotton-seed meal at $30 a ton.

6. With corn at 50 cents a bushel and oats at 40 cents, oil meal had a value of fully $60 a ton for feeding to work horses, with cotton-seed meal worth a trifle more still. At the usual prices of these feeds their use resulted in a substantial lowering of the cost of maintaining the horses.

While these experiments have not covered a sufficient period to warrant positive conclusions, the authors believe that the results have a considerable value.

SIMPLE QUANTITATIVE TESTS FOR CASEIN.

THE NEW YORK STATE STATION TEST.

An easy method to determine the amount of casein in milk has been worked out by Van Slyke and Bosworth[a] of the New York Agricultural Experiment Station. This test is of particular value to dairymen and cheese makers who want a rapid, accurate, and simple method for determining casein in milk without making a large outlay for chemical apparatus and the necessity of employing a skilled assistant to do the work. This test can also be used to advantage in the dairy schools—short course, etc., nutrition investigations, milk composition studies, state and municipal inspection

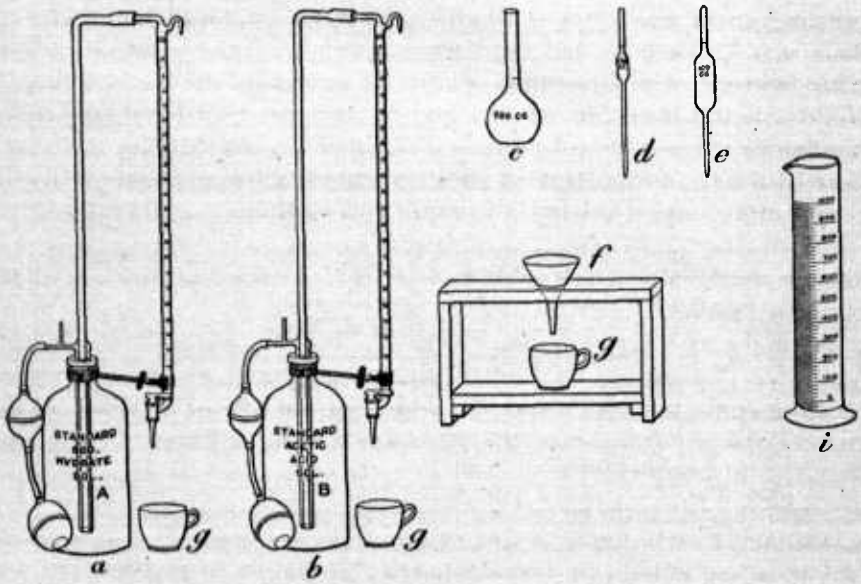

FIG. 2.—Apparatus and reagents required in the New York State Station casein test.

work, and with milk modification for infants. The apparatus and chemical reagents required (fig. 2), which can be obtained from any good supply house, are as follows:

(*a*, *b*) Titrating apparatuses consisting of two 50 cubic centimeter burettes, graduated in tenths of a cubic centimeter, two 5-pint bottles and the necessary connections.

(*c*) Two 200 cubic centimeter volumetric flasks (two flasks are required for each test), having necks 4½ to 5 inches long with an inside diameter of three-fourths inch, and the 200 cubic centimeter mark 1½ inch above the globe-shaped portion of the flask.

[a] New York State Sta. Tech. Bul. 10.

(*d*) One 17.6 cubic centimeter pipette delivering 17.5 cubic centimeters.

(*e*) One pipette to deliver 100 cubic centimeters.

(*f*) Some funnels, either glass or enameled iron, 3 to 4 inches in diameter.

(*g*) Some ordinary white teacups holding 200 cubic centimeters or over.

(*h*) Filter paper or fine mesh linen cloth cut in disks.

(*i*) A 1,000 cubic centimeter measuring cylinder.

(*j*) Normal solutions, one of sodium hydrate and one of acetic acid. These solutions must be absolutely accurate and should be obtained from a thoroughly reliable chemical firm. In order to prepare these solutions for use in the test, measure out 79.5 cubic centimeters of each in a separate 1,000 cubic centimeter cylinder or flask and fill each up to the 1,000 cubic centimeter mark with distilled water. The solutions are then poured in the bottles which come with the titration apparatus (*a*) and (*b*)—that is, those which are connected with the burettes. Each of these solutions thus prepared we term a standard solution; we have, then, a standard acetic acid solution and a standard sodium hydroxid solution.

(*k*) A solution of phenolphthalein in 50 per cent alcohol, made by dissolving 1 gram of phenolphthalein in 100 cubic centimeters of 50 per cent alcohol.

To make the test, measure out 17.5 cubic centimeters of milk with the 17.6 cubic centimeter pipette into one of the 200 cubic centimeter flasks, add about 80 cubic centimeters of distilled water and 1 cubic centimeter of the phenolphthalein solution. Then add slowly and dropwise from the burette A some standard sodium hydrate solution, shaking vigorously after each addition until just a faint permanent pink tinting of the milk is obtained (the authors find it to advantage to use a specially prepared color standard for comparison). When this pink color is obtained—the milk is then, so to speak, neutralized—we heat the milk to a temperature between 65 and 75° F. and add standard acetic acid solutions in 5 cubic centimeter amounts from the other burette B, shaking after each addition until 25 cubic centimeters have been added. If at this point the casein does not settle readily and in large flakes, add more of the standard acid (1 cubic centimeter at a time) until the desired result is obtained. The number of cubic centimeters of standard acid used is recorded as A. The flask is then filled up with distilled water to the 200 cubic centimeter mark, the contents vigorously shaken for about ten to fifteen seconds, and then filtered through dry filter paper or fine meshed linen into a dry teacup or beaker glass. The filtrate obtained should be clear. One hundred cubic centimeters

of this filtrate is then measured out by means of the pipette (fig. 2) into another dry teacup. To this we add standard sodium hydrate solution, dropwise, until we get a faint but permanent pink coloration which should remain a half minute or so before beginning to fade. The number of centimeters of standard sodium hydrate solution used is recorded as B.

To calculate the amount of casein in the milk we use the following formula: $\frac{A}{2} - B =$ per cent of casein in milk. Divide the figure recorded as A, which equals the number of centimeters of standard acid solution used, by 2 and from the result obtained subtract the figure recorded as B, or the number of centimeters of standard alkali used. The figure obtained represents the percentage of casein in the milk.

For example: A milk required 30 cubic centimeters of standard acid solution to precipitate the casein, thus $A=30$. The amount of standard sodium hydrate solution required for 100 cubic centimeters of the filtrate was 11.95 cubic centimeters, thus $B=11.95$. The calculation is then $\frac{\frac{A}{30}}{2} = 15 - \frac{B}{11.95} = 3.05$ per cent of casein in the milk.

THE HART (WISCONSIN STATION) TEST.

The Wisconsin Station has introduced a test by Hart,[a] which presents some good features, namely, the percentage of casein can be read off directly, not necessitating calculation, and it is as easily executed as the Babcock test for fat. For this test it is necessary to have the following apparatus and chemicals (fig. 3):

(*a*) Testing bottles: These are very much like an inverted Babcock bottle and can be bought from any leading dairy supply house.

(*b*) A centrifuge, very much like the one used in the Babcock test, only with the exception that the test-bottle holder is different.

(*c*) A test-bottle rack. This can also be made from an ordinary board with borings in it and with a block at each end for supports.

(*d*) A 100 cubic centimeter measuring cylinder, graduated in cubic centimeters.

(*e*) One 1,000 cubic centimeter bottle for diluting the acetic acid.

(*f*) One 50 cubic centimeter burette with a glass stopcock for measuring out the chloroform and stand.

(*g*) One 5 cubic centimeter pipette for measuring out the milk.

(*h*) One 20 cubic centimeter pipette for measuring out the acetic acid.

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[a] Wisconsin Sta. Bul. 156; Circ. Inform. 10.

(*i*) Chloroform, pure. Do not buy over 2 pounds. It can be bought from any good local drug store or dairy supply house.

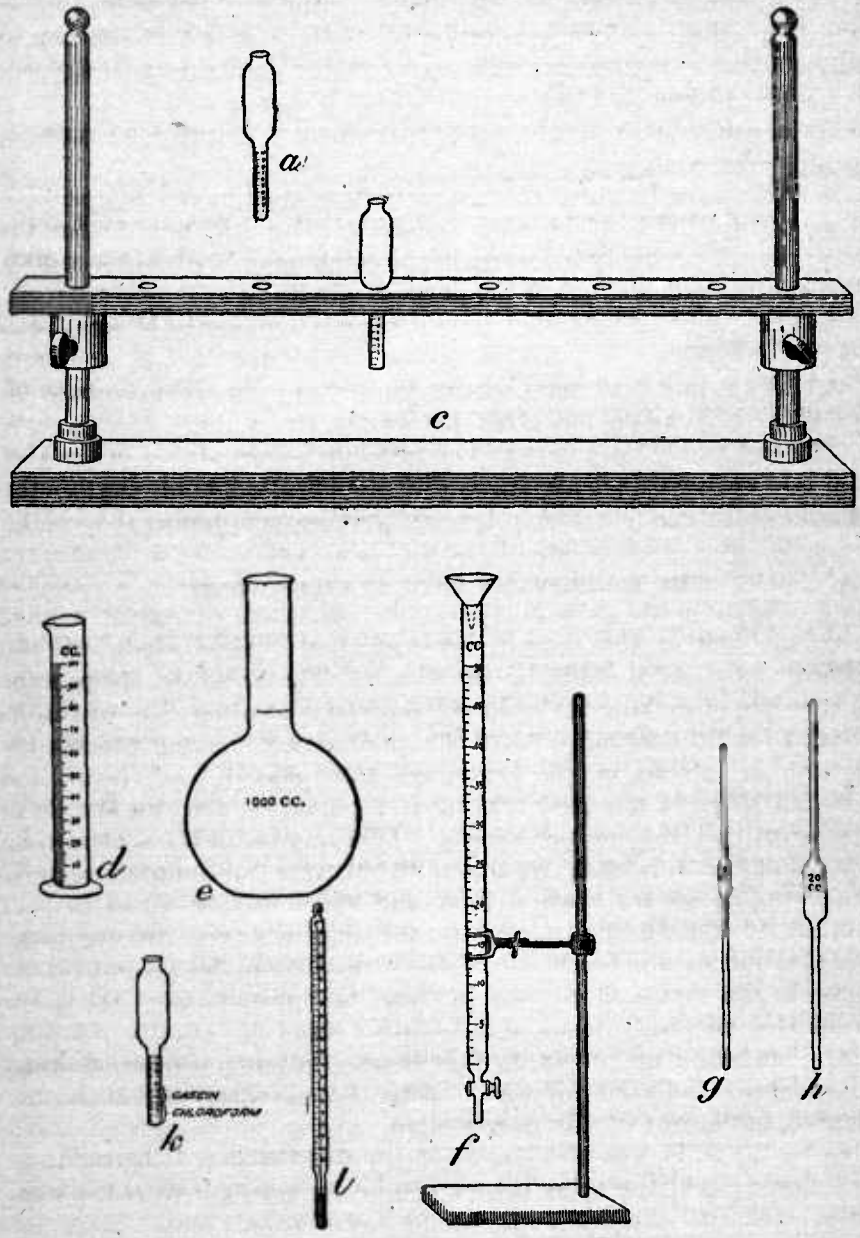

FIG. 3.—Apparatus required in the Hart (Wisconsin Station) casein test.

(*j*) A 0.25 per cent solution of acetic acid. This can be made by diluting glacial acetic acid (99.5 per cent pure—this can also be

purchased from any good dairy supply or drug house) tenfold with clear rain water or condensed steam (10 cubic centimeters of acetic acid to 90 cubic centimeters of water) making a 10 per cent solution, and then diluting 25 cubic centimeters of the 10 per cent solution up to 1,000 cubic centimeters with water in the flask shown in figure 3.

(*l*) One Fahrenheit thermometer, 212° F. (narrow bore).

As a preliminary to the test the following precautions must be strictly observed:

(*a*) The room in which the testing is done must have a temperature from 60° to 70° F. The cheese-making room will not do for this work, as it is probably too warm in the summer and too cold in winter. The curing room may serve the purpose admirably.

(*b*) The milk to be tested should have a temperature from 65° to 75° F.

(*c*) The acetic acid must have a temperature in the neighborhood of 70° F. (Not over 5 degrees one way or the other.)

The test is done as follows: The test bottles are placed in the rack and into each bottle is measured with the burette 2 cubic centimeters of chloroform. Then add to the test bottles containing the chloroform 20 cubic centimeters of the 0.25 per cent acetic acid solution, and finally with the pipette 5 cubic centimeters of the well-mixed milk. Each of the test bottles is then successively taken, corked with the ball of the thumb, inverted, and shaken vigorously for fifteen to twenty seconds by the watch. The accurate observation of the time of shaking is absolutely necessary, as otherwise the results obtained will be wrong. After this preliminary shaking process the bottles are placed in the centrifuge and whirled from seven and one-half to eight minutes, making it a point to turn the handle of the centrifuge 56 times per minute. (The number of times of turning the handle can be well regulated by using a metronome, such as music pupils use for beating time, and which can be tuned to beat audibly 56 times a minute.) After the whirling or centrifuging process the bottles are taken out of the centrifuge or tester and placed again in the rack and allowed to stand for ten minutes. (It is not absolutely necessary to have the bottles stand for exactly ten minutes—can stand up to twenty-four hours—but in no instance must they rest less than ten minutes.) After the necessary time of rest has elapsed the height of the precipitated curd or casein can be measured on the scale, which is etched on the test bottle. It is best done as follows: Hold the tube in a perpendicular position with the scale on a level with the eye and observe the divisions which mark the highest and the lowest limits of casein. (See fig. 3, *k*.) The difference between them gives directly the percentage of casein in the milk.