

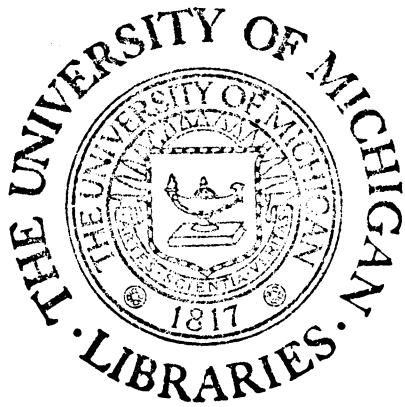
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THE PHILIPPINE
AGRICULTURAL REVIEW

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The Philippine Agricultural Review

A MONTHLY PUBLICATION ISSUED IN ENGLISH AND SPANISH AND CIRCULATED FREE OF CHARGE IN THE PHILIPPINE ISLANDS

PRICE OF SUBSCRIPTION

In the United States, \$1 United States currency, per year; in foreign countries in the Postal Union, \$2 United States currency, per year.

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PUBLISHED BY THE
BUREAU OF AGRICULTURE
DEPARTMENT OF PUBLIC INSTRUCTION
GOVERNMENT OF THE PHILIPPINE ISLANDS

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MANILA
BUREAU OF PRINTING
1912

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PLATE I.—TYPICAL UNPRUNED MULTIPLE-STEM "NARANJITA" (TANGERINE)
ORANGE TREE, TANAUAN, BATANGAS.

THE PHILIPPINE
Agricultural Review

VOL. V

JANUARY, 1912

No. 1

CONTENTS AND ILLUSTRATIONS.

CONTENTS.

	Page.
Editorial	1
Report of the Director of Agriculture for the fiscal year ending June 30, 1911.....	5
Principal Philippine Imports and Exports—October.....	56
Temperature and Rainfall for Agricultural Districts in the Philippines—October.....	57

17
P55

ILLUSTRATIONS.

	Frontispiece.	Facing page—
PLATE I. Orange Tree, Tanauan, Batangas		
II. Arab Stallion "Hatim"		20
III. Para Seedlings in Bamboo Tubes.....		34
IV. Imported Nellore Bull and Cows.....		38
V. Imported Nellore Bullocks		44
VI. Types of Coconuts		50

EDITORIAL.

COOPERATION.

By the DIRECTOR OF AGRICULTURE.

One who has given any study, even in a very superficial way, to the agricultural conditions in the Philippines, must gain the impression at the very start that no considerable amount of results can be secured in bettering the conditions of the Islands without intelligent and efficient coöperation between the Bureau of Agriculture and the growers of the various crops, from the sale of which must come for many years the money resources of the people.

The Bureau of Agriculture might be organized in a most effective way, with thoroughly practical men in every division, able to render most efficient help in the way of information and advice, and yet, if the people who actually grow the crops do not avail themselves of the opportunity to get this help, the whole organization is practically without value. As the conditions now are in the Islands, large sums of money for carrying on work in

any Bureau not being available, no other way seems possible for rendering efficient aid except by coöperation. The way in which this may be brought about is very simple in theory, but how well it can be worked out in practice depends entirely upon the people for whom the Bureau and all its branches are organized.

The matter of bringing about such coöperative demonstration work is one of the most important facing the Bureau at this time. How this may be done may be illustrated very thoroughly by speaking of one line of work which has been started and promises to be very useful. Reference is made to the tobacco work being done by the Bureau in the Cagayan Valley. This work, which has recently been started, is to be continued along the following lines:

A small station is maintained at Ilagan in Isabela Province. It is not the intention to carry on at Ilagan any large or expensive line of activities, but it will be used as a center from which to work among all those tobacco planters who desire to coöperate. At the station will be grown tobacco of various varieties and under varying conditions, and an attempt will be made to illustrate proper methods of cleaning seeds, curing and packing tobacco, and all other practical questions which come up to the planter. By far the larger and more important work, however, will be through asking tobacco growers to coöperate with the station by planting small plats under such conditions and of such varieties as are recommended by the Bureau, with a further agreement that the cultivation, gathering, curing, and packing of tobacco from these tracts shall be done with the help and assistance, in an advisory way, of the Bureau. There is no doubt that within a very short time the value of the tobacco produced in the valley may be increased very largely in proportion to the area planted.

If intelligent and effective coöperation like this is carried on in the same way, there is no reason why assistance may not be given by the Bureau in the growing of rice, sugar, rubber, coconuts, fruits, vegetables, and in fact all the agricultural products either now grown in the Islands or which may be successfully introduced.

A few dozen coöperative demonstrations—such as has been described in the case of tobacco—applied to all of the other crops mentioned, as well as to any others which can be grown here, would, in a very short time, show the varieties of soil-products which are adapted to the different localities and greatly increase the actual amount received from the sale of the various crops. In the case of rice, the Bureau has growing nearly a

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thousand varieties of the grain from which are being selected those kinds best adapted to the manifold conditions, and in another year the Bureau will have seeds of these selected varieties for distribution to those growers who will agree to carry out coöperative demonstration work, enabling the Bureau to learn what kinds are adapted to the different localities and to point to the results which have been reached under conditions which can be met by any grower.

The Bureau is extremely anxious to get in touch, as rapidly as possible, with all those growers of crops anywhere in the Islands who are willing to coöperate in any way. Applicants for an opportunity to carry on such work should designate the crops which it is believed will succeed in the neighborhood, how much land is available, what soil-products are now successfully grown, and such other information as will enable the Bureau to select the varieties it believes would succeed in the district.

There are doubtless, in many parts of the Islands, varieties of crops which have been introduced or which may have originated in particular sections that are so much better than the average that they could well be introduced more widely in the same neighborhood and tried in other places where the probabilities indicate that they would succeed. The Bureau is desirous of knowing of all such cases as this and of receiving seeds or plants with which it may experiment.

Such coöperative demonstration work can be carried on most effectively and helpfully when the location is such that the fields may be visited and studied by as many interested people as possible. They should, except under special circumstances, be located near centers of population so their effect may be made as broad as possible through a knowledge of the results coming to many people in the immediate neighborhood. The Bureau is earnestly desirous of bringing about a large amount of such coöperative work and will particularly welcome helpful suggestions and requests from those who are sufficiently interested to join in such an arrangement.

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REPORT OF THE DIRECTOR OF AGRICULTURE FOR THE FISCAL YEAR ENDING JUNE 30, 1911.

CONTENTS.

	Page.		Page.
General statement	6	Plant industry—Continued.	
Organization	8	Plant investigations—Contd.	
Personnel	8	Forage plants—Continued.	
Veterinary division	9	Natal grass.....	30
Personnel	11	Velvet beans.....	30
Field work	11	Lyon beans.....	30
Rinderpest	11	Cowpeas	30
Contagious pleuro-pneumonia	14	Miscellaneous forage plants	30
Surra	16	Horticulture	31
Foot-and-mouth disease	16	Mangos	31
Glanders	16	Bananas	32
Anthrax	16	Papayas	32
Rabies	16	Pineapples	32
Hemorrhagic septicemia.....	17	Citrus fruits.....	32
Research work	17	Avocado pears.....	33
Quarantine service.....	18	Miscellaneous fruits.....	33
Manila	18	Vegetables	33
Cebu	18	Fibers	34
Iloilo	19	Abacá	34
Meat inspection	19	Maguey	34
Animal husbandry	19	Cotton	34
Bureau stock farms.....	19	Kapok	34
Alabang stock farm.....	19	Miscellaneous plants.....	34
Trinidad stock farm.....	20	Rubber	34
La Granja Modelo.....	20	Coffee	35
Breeding work at Bureau farms..	21	Sugar cane	35
Horses	21	Cacao	35
Cattle	21	Mulberry	35
Milch goats	22	Annatto	36
Swine	22	Camotes	36
Public breeding stations.....	23	Forest trees	36
Purchase and sale of animals....	23	Seed distribution	36
Plant industry	24	Entomological investigations	37
Plant investigations	24	Experiment stations	40
Cereals	24	General investigations	40
Rice	24	Singalong experiment station.....	41
Forage plants	24	Supervision and labor.....	41
Guinea grass	25	Climatic conditions	41
Corn	25	Fertilizers	41
Pará grass	26	Pests	41
<i>Paspalum dilatatum</i>	27	Crops	41
Molasses grass.....	27	Lamao experiment station.....	42
Tunis grass.....	28	Supervision and labor.....	42
Sudan grass.....	28	Climatic conditions	42
Rhodes grass.....	28	Fertilizers	42
Beggartweed	29	Pests	42
<i>Panicum hirsutissimum</i>	30	Crops	42

	Page.		Page.
Experiment stations—Continued.		Machinery and building division—	
Trinidad garden	42	Continued.	
Supervision and labor.....	42	Other farm machinery.....	49
Permanent improvements....	42	Expert advice.....	49
Climatic conditions	42	Buildings	49
Irrigation and fertilizers....	43	Agricultural extension work.....	50
Crops	43	Nature of work.....	50
La Granja Modelo.....	43	Organization	50
Supervision and labor.....	43	Lecture work.....	50
Climatic conditions	44	Inspection work.....	50
Water supply	44	Coöperative demonstration work	50
Permanent improvements....	44	Fairs and exhibits.....	51
Fertilizer experiments.....	44	Agricultural associations	51
Pests	44	Publications	51
Crops	45	The Philippine Agricultural Re-	
Bacolod exposition.....	45	view	51
Ilagan tobacco station.....	45	Other publications.....	52
Supervision and labor.....	45	Crop reporting and statistics.....	53
Permanent improvements....	46	Special investigations.....	54
Crops	46	Investigations by Prof. C. V.	
Machinery and building division.....	46	Piper	54
Forage factory	46	The forage board.....	54
Power plowing.....	48		

DEPARTMENT OF PUBLIC INSTRUCTION,
BUREAU OF AGRICULTURE,

Manila, August 1, 1911.

SIR: I have the honor to submit herewith the Tenth Annual Report of the Director of Agriculture for the Philippine Islands. This report covers the period from July 1, 1910, to June 30, 1911.

GENERAL STATEMENT.

The year just concluded has been marked by developments of more than usual significance, not only to the Bureau of Agriculture but also to the entire agricultural interests of these Islands. The long period of industrial depression, brought on by war, drought, cholera, rinderpest, and the locust pest, from which the Philippine Islands have suffered for more than a decade, appears to be giving way to a period of development and prosperity. Improved agricultural conditions are to be noted throughout the greater part of the Archipelago. The sugar industry, stimulated by the removal of the duty on Philippine sugar imported into the United States to an amount considerably larger than our present total exports, is coming into rapidly increasing prominence and is beginning to receive the serious attention of both local and foreign capitalists. The high price of copra, which promises to be permanent, has brought prosperity to all of the coconut-growing sections, and the area planted to coconuts is being largely increased. Abacá, the export product of first importance, continues to suffer from low prices. The indica-

tions, are however, that there will be no further decline; improvement in the quality of fiber by the introduction of fiber-cleaning machines, and more careful methods of preparation, should, in a measure at least, restore this industry to its flourishing condition of earlier years. Tobacco has suffered from a lessened demand in the United States for Philippine tobacco, due to factors which do not require detailed discussion. The most promising feature of the tobacco industry at present is the increased interest shown by the growers in the production of a better quality of tobacco. When such improvement becomes more general there will be a correspondingly increased demand at better prices for Philippine tobacco.

The damage done by locusts during the year has been comparatively small, and the active measures taken for the extermination of this pest are already beginning to show results. Animal diseases, principally rinderpest and surra, continue to be the one great blot on what is otherwise a most encouraging agricultural situation. The heroic efforts that are being made to bring under control and eventually eradicate these diseases from the Philippine Islands are discussed in detail in this report. In November, 1905, the veterinary corps of the Bureau of Health was transferred to the Bureau of Agriculture. From that date to the present time the work of the Bureau of Agriculture has, of necessity, been largely defensive rather than constructive. Inasmuch as dangerous epizoötic animal diseases, which have threatened the very existence of our agriculture, have been widespread throughout the Archipelago, the control of these diseases has been considered the work of first importance. With but limited funds available, it has been necessary to neglect in a large measure other important lines of work. As a result of this policy the Bureau has been subjected to the severest criticism, from which it will continue to suffer until such time as it may become possible to carry on in a larger measure the constructive work for which there is such urgent demand.

During the past year the work of the Bureau has been reorganized, and it is now established on a broad basis that will admit of such future development as available funds will permit. The staff has been materially strengthened, and considerable in the way of direct results has already been accomplished. While it is essential both to the present and the future prosperity of the Islands that there should be no lessening of the activity in the work of disease eradication, it is of only secondary importance that provision be made for developing the constructive work of the Bureau. The only solid foundation for the

improvement of industrial conditions in the Philippine Islands is agricultural prosperity. It is believed, therefore, that every effort should be made to promote the development of our agricultural resources, and that the Bureau of Agriculture should receive in the future an even larger measure of support than it has received in the past.

ORGANIZATION.

On July 1, 1910, the work of the Bureau of Agriculture was reorganized, with a view of promoting increased efficiency under existing conditions and of providing for future development. Under the new organization 10 divisions were created, 4 of which were placed under the administrative supervision of the Director, 3 under the Assistant Director, and 3 under the Assistant to the Director, as follows:

DIRECTOR.

Clerical, finances and property, veterinary, animal husbandry.

ASSISTANT DIRECTOR.

Plant industry, experiment stations, machinery and building.

ASSISTANT TO THE DIRECTOR.

Agricultural extension work, publications, statistics.

This organization has been found satisfactory and will be continued.

PERSONNEL.

The following have been the more important changes in the personnel of the Bureau during the year: Chief veterinarian, appointed July 3, 1910; pathologist, appointed July 25, 1910; veterinary entomologist, appointed September 8, 1910; superintendent of experiment stations, appointed October 15, 1910; tobacco specialist, appointed September 1, 1910; horticulturist, appointed March 14, 1911; fiber expert, appointed August 6, 1910.

Thirty-six Americans have been appointed to classified positions, and 14 have been separated by resignation and transfer—a net increase of 22. Seven Filipinos have been appointed to classified positions, and 3 have been separated by resignation and transfer—a net increase of 4.

The number of temporary employees appointed and separated during the year has far exceeded that of previous years, this being due principally to the large increase in veterinary field work.

VETERINARY DIVISION.

The most important event in this division during the fiscal year was the arrival from the United States on July 2, 1910, of Dr. A. R. Ward, chief veterinarian. His appointment was made during the last fiscal year but he was unable to sever his connection with the University of California and report here for duty until after the beginning of this year. As soon as he reported for duty he was given entire charge of the veterinary division and Dr. F. C. Gearhart, who had been acting chief veterinarian for more than two years, was relieved and appointed chief of the division of animal husbandry. Dr. R. F. Knight, one of the district veterinarians, was appointed assistant chief veterinarian to take active charge of the office work of the division.

Doctor Ward began a systematic research of the literature on rinderpest, pleuro-pneumonia, and other diseases, the suppression and control of which are the principal work of this division; he also planned and began systematic laboratory experiments with a view of determining some of the technical questions and obscure points in the nature and control of these diseases. These lines of work consumed the most of his time during the first six or eight months of the year and left him but little opportunity to look after the field work of the division. The district and provincial veterinarians continued to follow the methods previously used with such modifications, from time to time, as Doctor Ward saw fit to put into force. After the discontinuance of the use of serum, Dr. C. G. Thomson, formerly superintendent of the serum laboratory at Alabang, was relieved from duty there and given charge of the important field work. Before the close of this fiscal year he was given supervision of the field forces and is traveling extensively in the general oversight of the work and reorganization of the provincial forces, along lines necessitated by the changes in the plans of the field work.

The efforts of this division have been concentrated very largely on the suppression of rinderpest, which has shown a tendency to spread extensively during the year, especially in central Luzon, from Lingayen Gulf south to Manila, in the Islands of Leyte, Cebu, Siquijor, and in the Provinces of Oriental Negros, Surigao, Cagayan, and Isabela; the total number of municipalities infected at the close of the year was 81 as compared with 25 reported at the close of the previous year. The number of deaths from the disease and the corresponding interference with agricultural work and transportation in the provinces were correspondingly greater than during the previous year.

Doctor Ward has introduced into the work of the division a number of new features, principal among which are: The abandonment of the use of anti-rinderpest serum; the concentration of the efforts of the entire force on rinderpest alone in limited sections of the Islands, with a view to the entire suppression of the disease there before undertaking work in other territory; the advocacy of the extensive use of fencing as a quarantine measure against the movements of infected animals; there was also introduced into the work in Pampanga, Bulacan, and Cavite Provinces, a system of "voluntary coöperation" by the officials and people of the municipalities where the disease existed. This latter plan was advocated by the Executive Secretary and in carrying it out the veterinarians act simply in an advisory professional capacity when their assistance is called into requisition by the people of the community.

During the year much more extensive use of the police power has been made than ever before, the forces being drawn from local Constabulary companies and Philippine Scouts detailed on special duty with the Bureau of Agriculture. There was also a considerable increase in the number of employees engaged in the veterinary work and correspondingly in the expenditures.

The efforts of this Bureau to secure an adequate appropriation to be used in the condemnation and slaughter of infected animals were again unsuccessful, but His Excellency the Governor-General authorized the expenditure of a small sum in this direction in order to test the merits of this plan. The entire suspension of the shipment of live cattle from Hongkong was finally accomplished during this year, as they continued to bring disease as long as they were permitted to be landed under any conditions. Cattle and carabaos imported from Indo-China continued to arrive in excellent condition until about the close of the year when an extensive outbreak of foot-and-mouth disease appeared among the animals of one importation from which it spread to several provinces. Special arrangements were perfected by importers for the construction of temporary stockyards at Sisiman Bay on the military reservation and orders issued permitting the importation of Australian cattle for slaughter from the Wyndham District, from which place pleuro-pneumonia was imported about the close of the last fiscal year.

In the concentration of the efforts of this division on the work with rinderpest, the suppression of surra has been largely abandoned, though there does not appear to be any extensive spread of this disease.

On June 13, 1911, His Excellency the Governor-General

directed that the entire supervision of the veterinary division be vested in Doctor Ward, who should report direct to the Secretary of Public Instruction and the Governor-General on matters pertaining to this division. As he had enjoyed the same authority under the Director of Agriculture during that portion of the year prior to this date, the body of his report is quoted as follows:

PERSONNEL.

At the beginning of the fiscal year 1911 there were on duty 41 veterinarians, 6 American live-stock inspectors, and 56 Filipino live-stock inspectors. On June 30, 1911, there were 47 veterinarians, 1 veterinary pathologist, 1 veterinary entomologist, 56 American live-stock inspectors, and approximately 300 Filipino live-stock inspectors. During the year 3 veterinarians resigned from the service and 8 were granted leave for the purpose of visiting the United States. There were 7 veterinarians appointed during the fiscal year 1911, not including the pathologist and entomologist.

FIELD WORK.

During the past year circumstances have indicated the desirability of concentrating the efforts of the division upon rinderpest to even a greater degree than in previous years.

Rinderpest.—At the beginning of the year the most serious problem arising was that concerning the results that were being obtained by the use of anti-rinderpest serum. An exhaustive series of investigations led to the conclusion that under conditions existing in the Philippines equally good results might be obtained by other methods and its use was discontinued. It is interesting to note that, after the conclusion of the experiments, it was discovered that similar experimental work had been carried on in India with conclusions confirming those of this Bureau, so far as the work was duplicated.

Following the discontinuance of the use of serum, the effort to control rinderpest was centered upon the object of keeping animals separated from one another and upon detecting the diseased animals, so that they might be placed under restraint in corrals. These requirements necessitated greater concentration of employees in order to accomplish the desired results. When veterinarians and their assistants available for this work are somewhat uniformly scattered throughout a known infected territory, experience has shown that they are ineffective, because each group is coping with an impossible task. A few municipalities in a province might be successfully ridden of disease,

but while this is being done others are being neglected, and when attention is drawn to the others, the first municipalities that were cleaned up might again become infected. Isolated examples of disease eradication like this are not permanent and do not contribute to the final restriction of the territory harboring rinderpest. A year of such work will show a gratifying number of municipalities where the disease has been eradicated, but a consideration of the total number infected at the beginning of the year and at the end of the year may show no progress. The gain resulting from such work is merely the lessening of the losses in the community involved, without permanent eradication.

With scattered forces, the losses from rinderpest may be minimized, but under such conditions the actual amount of territory containing infected animals cannot be reduced. The work during the year has been of two classes: First, scattered effort as described, covering about eight months; secondly, the marked concentration of effort in a few localities looking to the discovery of the last case of rinderpest in that territory and the consequent eradication of the disease.

Concentration affords an opportunity to standardize methods and closely supervise the work of employees. This leads to a better knowledge of the individual qualifications of men and adds to our knowledge of the results following a given system of procedure. When men are scattered, supervision is difficult and so many individual methods of conducting the work spring up that the central office cannot draw valuable conclusions from field experiences. A valuable feature of concentration lies in the fact that it affords means of obtaining information as to the actual amount of disease prevalent, which cannot be obtained without a large number of employees in a given area. The ultimate goal of concentrated effort is the extinction of rinderpest in the area involved, followed by similar effort in contiguous areas with the aim of ultimately covering the whole of the infected area.

The year has witnessed the abandonment of the idea that municipal police are effective or available in numbers enough to constitute an important feature in controlling the movement of animals, which requirement is of prime importance in the campaign in progress.

Constabulary have been utilized to a greater extent than formerly and are extensively employed throughout the Islands, except in those places where the most concentrated effort is being employed. The Bureau of Constabulary has most generously and willingly contributed aid up to the very limit of the facilities available.

The concentration of effort against rinderpest in Pangasinan and Occidental Negros was made possible only through the broad-minded public spirit shown by the Commanding General, Philippines Division, in assigning some 1,200 Scouts, 41 cavalymen, and 5 veterinarians for duty with the Bureau of Agriculture. The officers, enlisted men, and veterinarians have made the cause of the Bureau of Agriculture their own. They have worked with an enthusiasm and esprit de corps that augurs for success. The number of Scouts available has been limited only by the number of available employees of the Bureau of Agriculture necessary to utilize Scouts advantageously.

The importance of the animal-industry interests of Pangasinan and other considerations indicated the desirability of beginning there the quarantine work with Scouts. As a preliminary, a training school in charge of a veterinarian was instituted for the purpose of instructing live-stock inspectors and soldiers in the recognition of rinderpest and fundamental sanitary principles underlying the work. This was conducted by means of informal talks and demonstrations with sick animals as subjects. The Scouts are used as patrols with the double duty of preventing the unauthorized movement of animals and of detecting animals suspected of being infected with rinderpest.

The problem of combating rinderpest is quite different from the popular notion. So far as known at present there is only one area where rinderpest is causing serious losses. In the greater portion of the infected area, the disease is very scarce and mild in character, but sufficient to keep alive infection. In many places where the disease has existed for a long time the greater portion of the animals, the older ones, are immune to the disease, the losses occurring among younger animals. This situation is serious enough in itself because it constitutes a steady drain on the animal resources and is an obstacle to the accumulation of a proper and desirable number of cattle and carabaos. The greater menace in such a situation lies in the fact that disease infection is kept smoldering in spots to cause extensive losses when introduced into districts that have been free for years and have become heavily stocked with susceptible animals. For instance, during the outbreak at Davao 100 per cent of those attacked died, while it is doubtful if 50 per cent died in Pangasinan. When losses are not great, the disease is not at all alarming to stock owners in general nor to officials. The detection of cases of rinderpest under such circumstances is a task which must be accomplished by scouts and representatives of the Bureau of Agriculture. It calls for the most thorough work for the

detection of the last suspicious case, for thorough organization and painstaking work.

As a preliminary, a census of animals as required under Executive Order No. 24 is obtained from the municipal president. With this as a basis an independent census of the animals in each barrio is made and this is always a larger list than that furnished by the president, for by no means all the animals are registered that should be. With this census as a basis the animals in infected barrios are scrutinized for a sufficient length of time to insure that they are free from disease. The results that are being obtained where the forces are concentrated are entirely satisfactory.

Slaughter has been employed in a tentative and experimental way. When first instituted it was thought that the offer to pay for sick animals would encourage owners to bring them to the attention of the veterinarians. In several places it was noted that stock owners would hesitate about reporting cases because such reporting resulted in their other animals being placed in quarantine, which was regarded as offsetting the advantage of having pay for the sick animals. For instance, in one province, animals were seldom reported until on the verge of death and then not until every other animal in the barrio had been taken elsewhere to avoid quarantine. Such a result naturally rather encouraged the spread of disease than otherwise.

From experiments conducted at Alabang for the purpose of determining when an animal suffering from rinderpest is infective to other animals, the fact developed that cases cease to be dangerous to other animals shortly after diagnostic symptoms are fully developed and that animals in the very earliest stages also spread disease. Under conditions obtaining in the Philippines it is difficult to determine what other animals have really been in contact with the sick ones. Hence, slaughter can not include exposed animals and thus is not the thorough measure that it should be and is when employed in fenced countries.

Owing to the difference in the methods employed for detecting and reporting disease at the beginning and end of the fiscal year, it is impossible to present figures that would mean anything in relation to the gain or loss in the number of infected municipalities or provinces.

Contagious pleuro-pneumonia.—Shortly before the beginning of the fiscal year reported upon, extensive importations of live cattle from northern Australia occurred. These cattle were extensively distributed throughout Luzon. The discovery of con-

tagious pleuro-pneumonia among these animals at the matadero in Manila was a circumstance that called for prompt measures to avert its gaining a permanent foothold in the Philippines. A general order was immediately issued to provide for the slaughter under strict precautions in Manila of animals en route and to prevent further importations. Fortunately animals that had gone to the provinces were destined for slaughter. There was comparatively little difficulty in regard to these. Both in Manila and in the provinces there were a large number of cattle and carabaos that had been exposed to Australian animals and all of these were located and quarantined for four months when not intended for slaughter. In the course of the work, two native animals were found on slaughter to have contracted contagious pleuro-pneumonia. No evidences are at hand to indicate that the disease has become permanently introduced in the Islands.

The interdiction against the importation of Australian cattle affected dairy cattle as well as beef animals, and constituted a vexatious addition to the many obstacles in the way of supplying fresh milk to Manila. The character of Australian beef and its price made it a matter of regret that any conditions should render it necessary to stop the importations.

These conditions indicated the desirability of the most searching investigation of the animal disease conditions in Australia. Accordingly, Dr. F. C. Gearhart sailed on July 30, 1910, for Australia, with instructions to determine the possibility of obtaining healthy Australian dairy cows and cattle for immediate slaughter and to determine to what extent the Australian Government could cooperate in this matter. Doctor Gearhart spent several months in Australia, Tasmania, and New Zealand. On his return he prepared an admirable report on the animal disease situation in those countries. Reduced to the shortest possible statement his report showed that nowhere in Australia could there be obtained beef cattle absolutely free from contagious pleuro-pneumonia. Dairy and breeding stock could be safely imported under very strict precautions exercised with the assistance of the officials of the department of trade and customs of the Commonwealth of Australia. From Doctor Gearhart's report it was concluded that if Australian beef cattle were to be imported for slaughter that this might be done under conditions reducing to a minimum the danger of infection of local cattle to contagious pleuro-pneumonia. Accordingly, at the end of the period reported upon, arrangements are being made for the slaughter of Australian cattle in an isolated spot at Sisiman

Bay. Likewise dairy and breeding stock may be imported when accompanied by a certificate showing that they have come from a district free from that disease.

Surra.—This disease has been found in nearly all provinces of the Islands at some time during the past year. The infection is apparently widely disseminated but as cattle and carabaos show a great resistance to this disease no great loss is caused from it, unless it becomes prevalent in a district where there are a large number of horses. It spreads rapidly from one horse to another when these animals are running in large droves. Its spread in localities where the horses are stabled separately, or in small groups, has not been rapid.

Foot-and-mouth disease.—At the beginning of the fiscal year about 60 animals were infected by this disease and held in quarantine in one of the corrals in the city of Manila. During the months of July and August these animals were slaughtered at the matadero of Manila. During the months of September and October, foot-and-mouth disease was found in cattle imported from Hongkong, which were being detained on lighters in Manila Bay, but the infection was confined to the animals on the lighters, and no epizootic resulted from these importations.

In the month of June, the steamer *Spir* brought cattle and carabaos from Pnum Penh to Manila and Iloilo. These animals were infected with foot-and-mouth disease which was not discovered until after the animals had been landed. The importation of this infected shipment resulted in the infection of several provinces, but the measures taken to control the disease have, up to the present time, given favorable results. Subsequent shipments from Pnum Penh arrived infected with foot-and-mouth disease, but as the corrals in Manila were already infected, little harm could be done by the addition of a few more animals, and accordingly special provisions were made for the landing of all animals embarking from Pnum Penh prior to June 21.

Glanders.—A few cases of glanders have been discovered during the year. The majority of these cases have been found in the city of Manila, but a case or two is occasionally found in the provinces. This disease has not spread from one animal to another rapidly enough to be alarming.

Anthrax.—A few cases of anthrax have been found in the municipality of Taytay, Rizal Province, but this disease has not been discovered in any other locality in the Philippines during the year.

Rabies.—A very few cases of rabies were discovered in the

city of Manila. This disease has not been found or reported in the provinces.

Hemorrhagic septicemia.—There have been a few cases of hemorrhagic septicemia, the majority of which were discovered in the Province of Zambales. This disease has been confined almost entirely to the carabaos and has not caused any extensive losses.

The total reported deaths recorded from various diseases were 6,032 carabaos, 3,543 cattle, and 1,293 horses. For all practical purposes, the total deaths among cattle and carabaos may be attributed to rinderpest and those among horses, to surra. The occurrence of various diseases by provinces shows that rinderpest attacked 2,733 animals in Pangasinan, 867 in Leyte, 573 in Pampanga, 572 in Zambales, 450 in Bulacan, 410 in Surigao, 377 in Oriental Negros, with a total of 8,438 in all of the provinces.

RESEARCH WORK.

Minor alterations in the plant of the serum laboratory at Alabang adapted the buildings and sheds to accommodate research work. During the year extensive experimental work has been carried on and as a result scientific papers on the following topics are ready for publication:

Experiments on the Efficiency of Anti-rinderpest Serum. By A. R. Ward, C. G. Thomson and F. W. Wood.

Experiments upon the Transmission of Rinderpest. By A. R. Ward and F. W. Wood.

Notes on the Muscular Changes Brought about by the Inter-muscular Injection of Calves with the Virus of Contagious Pleuro-pneumonia. By W. H. Boynton.

A Note upon Strangles in the Philippine Islands. By W. H. Boynton.

A Note upon Anthrax in the Philippine Islands. By W. H. Boynton.

Experiments in the Transmission of Trypanosomiasis. By M. B. Mitzmain.

Notes on the Role of Carabao Lice in the Transmission of *Trypanosoma evansi*. By M. B. Mitzmain.

During the year research has been carried on in connection with a number of other topics, but progress is not sufficient to warrant publication as yet. Among the problems investigated are the filtration of rinderpest virus in blood and peritoneal fluid, pathology of intestinal lesions of rinderpest, normal cellular composition of blood of carabaos, abnormal changes in rinderpest, verminous bronchitis in carabaos, osteoporosis in the horse, blood changes in epizootic lymphangitis and the insect parasites of horses, cattle, and carabaos.

The work carried on has been dictated by the need for information in connection with field work, and the results have been immediately applied to such work with great benefit.

During a portion of the year the pathologist enjoyed the privileges of the Bureau of Science, where every courtesy and needed assistance was generously accorded him. The veterinary entomologist was quartered during most of the year at the San Lazaro immunizing station.

QUARANTINE SERVICE.

Quarantine service has been maintained during the year at Manila, Iloilo, and Cebu, but in the latter city no quarantine station has been available. Early in the fiscal year the construction of the Pandacan quarantine station had progressed to such an extent that it was possible to begin using it for quarantining live stock. Its incompleted condition left much to be desired, but, nevertheless, it offered better facilities for controlling disease than that offered by the corrals owned by the various dealers scattered throughout the city.

Importations from Australia were permissible only during seventeen days of the fiscal year. During the first five months, cattle from China were allowed to be imported with the restriction that all animals be held for ten days' quarantine after arrival, upon lighters in the bay. Both rinderpest and foot-and-mouth disease appeared among these animals and there was great danger of these diseases being carried ashore by the attendants. Consequently, a general order was issued imposing a three months' quarantine on all such cattle, which had the effect of prohibiting importation. Thus, the importation of cattle has been restricted to animals from Indo-China. At the very close of the fiscal year foot-and-mouth disease was discovered among shipments of cattle from Pnum Penh, Indo-China, and further shipments were discontinued until such time as that port shall be considered free from foot-and-mouth disease.

Stock yards and mataderos are being constructed at Sisiman for the reception of Australian beef cattle imported for immediate slaughter.

Manila.—During the year 112,397 head of live stock have been inspected on arrival by sea, of which 46,501 were imported, 65,896 domestic, and 21,018 were inspected before shipment to the provinces.

Cebu.—During the year 2,064 animals were inspected upon arrival by sea, of which 938 were removed from the city after inspection.

Iloilo.—During the year 16,935 head of live stock were inspected upon arrival by sea, of which 8,806 were removed from the city after inspection.

MEAT INSPECTION.

During the year 93,790 animals were inspected post-mortem at the Manila matadero, of which 712 carcasses and 48,052 parts were condemned post-mortem.

ANIMAL HUSBANDRY.

The division of animal husbandry was created on July 1, 1910. Dr. F. C. Gearhart, formerly acting chief veterinarian, was appointed the chief of this division. He was detailed on investigational work in Australia from July 31, 1910, to January 10, 1911, during which time Mr. C. W. Edwards was acting chief of the division. Due to the absence of Doctor Gearhart in Australia, and the great amount of routine work which has required his attention since his return, much of the work contemplated and planned for this division has not yet been completed. The work of the division of animal husbandry includes the supervision of Bureau stock farms, public breeding work in the provinces, the purchase and sale of live stock, and animal feeding tests and breeding experiments.

BUREAU STOCK FARMS.

There have been maintained during the year three stock farms, at Alabang, in Rizal Province, at Trinidad, in the subprovince of Benguet, and at La Carlota, in Occidental Negros. The first and last named are not exclusively stock farms, but are also used as plant experiment stations.

Alabang stock farm.—Much of the work on this farm during the year has been the improvement of the roads, buildings and irrigation system, and the raising of forage for the maintenance of the farm animals and the animals of the pathological laboratory. The production of forage crops, principally Guinea grass and sorghum, has been very satisfactory, and the cost of maintaining the live stock on this farm has thereby been greatly reduced. Only a small part of the imported feed usually furnished from Manila has been supplied during the year. With the exception of the Maltese and Spanish goats, all of the live stock has done much better than during former years. The stock at the Alabang farm is now in better condition than at any time since this farm was established.

There were sold during the year from this farm animals to the value of ₱9,686.14 as follows: Six horses, ₱1,697; 28 head of cattle, ₱1,006; 42 Berkshire pigs, ₱1,134; 128 rabbits and 1,716 guinea pigs ₱5,849.14.

At the end of the year there were on this farm 58 horses, 4 mules, 246 head of cattle, 35 swine and 40 goats.

Trinidad stock farm.—The cattle at this farm have continued to thrive in a very satisfactory manner and the herd has been maintained at a very small expense, no grain being fed except to the breeding bulls; the horses have done as well as usual, except for a small outbreak of osteoporosis, which affected about a dozen head.

Because of the limited amount of available pasture, the rugged nature of much of the grazing grounds, the cold rains, the impossibility of producing forage and the great cost of transporting feed from Manila, this farm has always been very unsatisfactory for the production of horses. There are no compensating advantages in producing horses on this farm, while the disadvantages are very apparent. It is believed that horse breeding should be discontinued at Trinidad, and that the horses now there should be removed, either to a new farm within easy reach of Manila or to Alabang and La Carlota.

During the year 19 cattle, 3 horses, 8 goats, and 7 sheep were sold from this farm, the total amount received for this stock being ₱2,475.

La Granja Modelo.—At the beginning of the year there were on this farm 19 American mares, 1 Morgan stallion, and 1 mestizo stallion. During the year there were transferred to this farm from other stations of the Bureau, 43 head of mares and colts, and 3 native stallions; 6 mares and 6 colts were lost by death.

A part of the Nellore cows have continued in very good condition during the year and the balance in fair condition; the bull is in prime condition; they have subsisted entirely on pasture. The herd of small Chinese cows have kept in excellent condition throughout the year and have dropped 21 grade calves, all vigorous.

The condition of the animals on this farm has been in general quite satisfactory, and the cost of maintenance per head has been less than at the other two stations. A large percentage of the American mares did not produce foals, and as they have been bred regularly and are not now pregnant, it appears that they are barren.

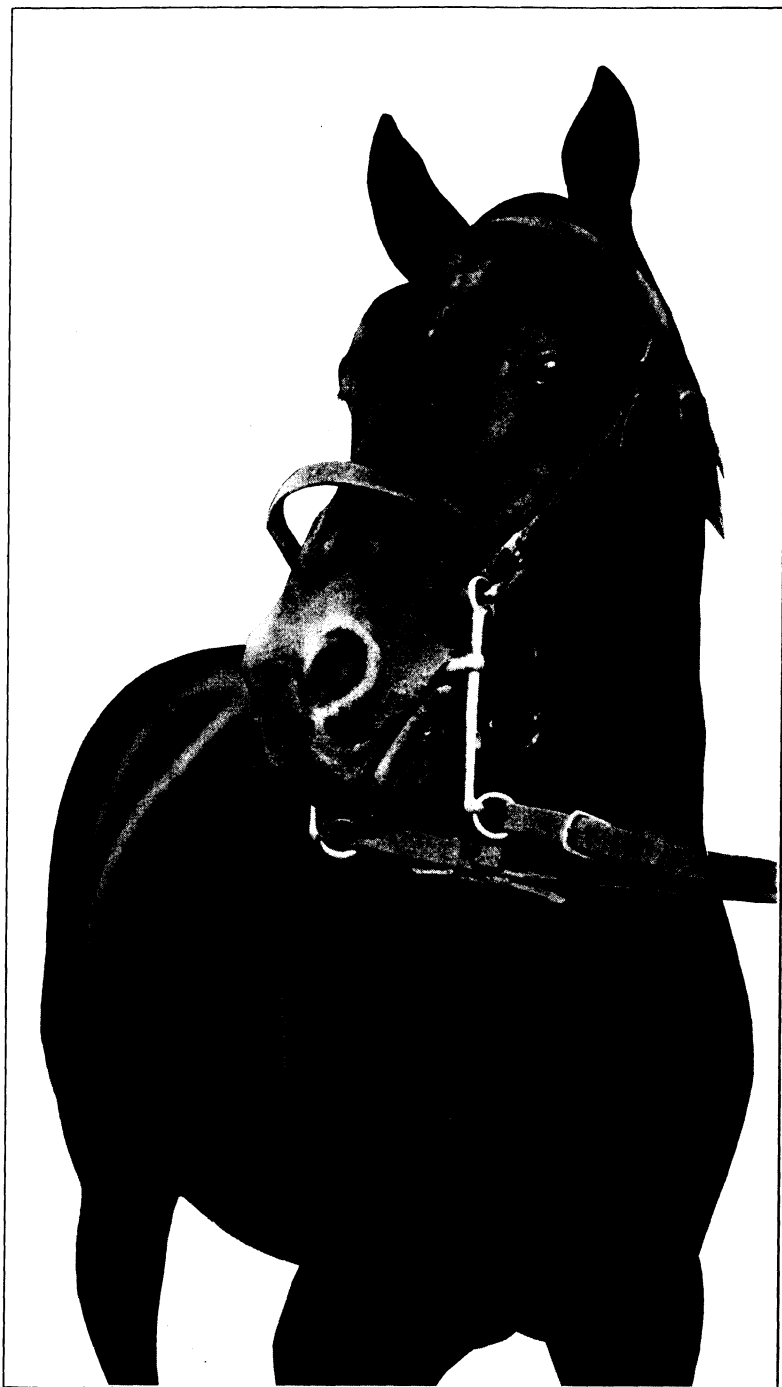


PLATE II.—IMPORTED ARABIAN STALLION "HATIM."

Property of the Bureau of Agriculture. Sire of many of the colts now owned by the Bureau.

BREEDING WORK AT BUREAU FARMS.

The production of good breeding animals for the use of the general public is the chief object and consideration in maintaining and operating the stock farms. The uncertainty, inconvenience and expense incident to importing breeding animals is very great. The desirability, therefore, of producing such animals in this country is apparent. The Bureau of Agriculture is now raising on its stock farms, and distributing to the public, horses, cattle, carabaos, milch goats, and swine.

Horses.—In producing horses to improve the native pony, the defects and excellence of both the native breed and the foreign breeds must be borne in mind. Considering the conditions under which most horses must be kept in these Islands, for at least the next decade, and the character of service required of them, the native breed as a whole can only be said to be inferior to the other breeds in size. They have certain defects, but are enough superior in quality of limbs, constitution, endurance, and adaptability to adverse conditions to more than compensate for these defects. The object, therefore, of the breeding work has been, primarily, to increase the size, and secondly, to improve the defects in conformation without sacrificing the good qualities of the native pony. The ideal method of doing this is by the careful selection, breeding, and feeding of the individuals of the native breed, without the introduction of outside blood. This method will require considerable time, and the demand for immediate improvement is so great that it has been considered advisable to introduce foreign blood. The Arabian breed has been selected as being the most satisfactory for this purpose. This breed has in the past formed the foundation of nearly, if not all, large, light horse breeds; it is the oldest breed in existence, and for this reason individuals of this blood breed truer to type, when crossed on other breeds, than do horses of American and European breeds. It is quite certain that the native pony of these Islands carries a strain of Arabian blood, and this fact is a further argument in favor of using pure-breed Arabian sires for crossing. The size of the Arabian is another advantage, as the individuals of this breed are large enough to greatly increase the size of the offspring, and yet not too large to copulate well with the small native mares.

Cattle.—The following lines of cattle breeding are now being carried on: (1) Pure Nellore; (2) Nellore-mestizo cross; (3) Nellore-native cross; (4) pure-bred Angus; (5) Angus-Galloway

and mestizo cross; (6) Galloway-native cross; (7) Hereford-native cross.

The breeding work with pure-bred Nellore cattle is considered to be the most important line of cattle breeding now being done by this Bureau. This breed has given excellent results in many countries, where they have been tried, and gives promise of being an important factor in the up-building of the cattle herds in this country. Being a working breed of large size and acclimatized to the Tropics, there is every reason to believe that they will prove to be ideal cattle for improving the small native animals. Two herds of pure-bred Nellore cattle are maintained, one at Alabang and one at La Carlota. At Alabang the Bureau has a herd of grade cows representing several crosses and breeds. Until recently, an Angus bull has been with this herd, but it has been necessary to replace him with a Nellore bull. An Angus bull will again be placed with the herd as soon as one can be obtained. At La Granja Modelo a herd of native cows, mainly of Chinese blood, is being crossed with the Nellore bull; very good results are expected from this cross. At the Trinidad stock farm the Bureau has two very fine pure-bred Angus cows that are being bred to a pure-bred Angus bull with the view to producing breeding animals to be used by the Bureau. A very fine herd of grade Galloway cows is kept at Trinidad; it has been impossible to obtain a Galloway bull and as the Angus and Galloway breeds are quite similar, an Angus bull is being kept with this herd. A herd of native cows (Spanish blood predominating) is maintained at Alabang; with this herd there is at present a Hereford bull. This line of breeding is largely experimental, as this cross has never been tried in the Islands before.

Milch goats.—The Bureau has two breeds of these useful animals, which should be of great value to the people of these Islands. As yet they are but little appreciated, due largely to the fact that the Filipinos are not, as a rule, milk consumers. Four herds of goats are maintained by the Bureau; one herd is composed of pure-bred and grade Maltese females with a pure-bred Maltese male; one of pure-bred Spanish milk goats and one of native female goats, which are crossed with a pure-bred Spanish male.

Swine.—The production of good breeding pigs is one of the important services being rendered by this Bureau and a great deal of interest has been taken by the people in this line of stock improvement. The demand for good breeding pigs, especially males, has thus far exceeded the supply. Only one breed, Berk-

shire, has been tried. This breed, which has all of the desirable qualities lacking in the native swine, and which is probably the most prepotent breed in existence, has proven to be of exceptional value for improving the native breed. Alabang is the main breeding farm for pigs, though a few are produced at La Carlota.

PUBLIC BREEDING STATIONS.

It is to be hoped that eventually a public breeding station can be maintained in every province. At these stations should be kept stallions, bulls, billies, bucks and boars, the services of which should be available to the public free of charge. This work can only be established gradually, as the necessary breeding males become available, and the provinces render assistance by furnishing the necessary lands and buildings. At present only stallions are furnished by the Bureau for the free use of the public; these are sent out usually three or more together under the charge of an experienced employee, and are moved from one town to another throughout the provinces. The people are evidencing great interest in this work and are presenting their mares for service in a very encouraging manner. The results obtained by the present method of moving horses from town to town are not in all ways satisfactory, and it is important that this method be replaced by permanent breeding stations. The mestizo colts obtained by the people who patronize the stallions are very highly prized by their owners, and when sold, have been bringing from two to three times the price usually paid for native ponies. Three hundred and thirty-seven mares were bred during the year.

PURCHASE AND SALE OF ANIMALS.

The Bureau has during the year selected, purchased, cared for, and shipped all of the live stock required by all branches of the Civil Government, with the exception of animals purchased outside of the Philippine Islands. The purchasing of animals used for experimental work by the veterinary division has been the largest single item. A great amount of time has been spent in the purchasing of horses and ponies because of the difficulty in obtaining satisfactory animals.

The Bureau has sold a great many of its own animals during the year; these consisted of breeding animals raised on the stock farms, completed serum bullocks, and experimental animals for which the Bureau had no further use. The young bulls, pigs and goats were sold direct to the public at fixed prices; all others, when sold to the public, were usually disposed of at public auction.

PLANT INDUSTRY.

The division of plant industry includes all general plant investigations, seed and plant distribution, and entomological investigations. Under the subject of "Plant Investigations" in this report is included work done both in this division and in that of experiment stations.

PLANT INVESTIGATIONS.

CEREALS.

Rice.—The rice work, both at the Alabang stock farm and at the Lamao experiment station, has been continued along practically the same lines as during the last fiscal year. In addition to these main stations a new testing station has been established on the "Luisita Estate" at San Miguel, Tarlac Province. The rice investigations include field tests under varying conditions of all obtainable varieties of both lowland and upland rice, and laboratory study and classification of these varieties. Plat tests were made at Alabang last year of 165 varieties of lowland rice. Four hundred varieties are being tested this year, nearly all of which appear to be distinct. Some 355 varieties of upland rice were planted at Lamao last year. This year 474 varieties, comprising practically all of the upland types, are under cultivation at Lamao. The examination, classification, and tabulation of data pertaining to this large number of varieties involves a large amount of detail work, but the completed results will comprise an exhaustive investigation of the most important staple crop of the Islands.

FORAGE PLANTS.

At the Singalong, Lamao, Trinidad, and La Carlota stations, and at the Alabang and Trinidad stock farms, collections of legumes and grasses, believed to be more or less adapted to Philippine conditions, have been planted with the idea of testing them as forage crops. This work has been under the management of Prof. C. V. Piper, agrostologist of the United States Department of Agriculture. Since this work must extend over one entire season, completed results have not as yet been obtained. Other projects, outside of the Bureau but more or less directly under its management, have been outlined for the testing of forage plants. The estates of the Compañía General de Tabacos de Filipinas at San Miguel, Tarlac Province, and the Roxas estate at Calauan, Batangas Province, have been selected as suitable places for this work. Some of the introduced forage

species have been very successfully grown at the Alabang stock farm and bales of the most promising sort have been put up for the purpose of testing their keeping qualities in storage.

Guinea grass.—Guinea grass has been the principal crop at the Singalong station and has been grown both for forage and for distribution. The area devoted to this crop has been about 2½ hectares and the yield about 115 tons per hectare for the entire year. All of the area planted to Guinea grass has been dug for roots during the year and one-half hectare was dug a second time. It has been noticed that growing even one crop of corn on the land seems to improve it for Guinea grass. One plat that has been in corn continuously for 6 crops was planted to Guinea grass in September. The grass on this plat made a much more thrifty and even growth and had a better color than that grown on land which is kept continuously in grass. Guinea grass is an important crop at the Alabang stock farm and is considered the most valuable forage crop that has been grown at this farm up to the present time. It has been found necessary at Alabang to replant Guinea grass about once every twelve months as if this is not done it becomes gradually shorter and more fibrous until finally it is not worth cutting. This deterioration is not so noticeable, however, where there is an abundance of irrigation. Certain fields of Guinea grass at Alabang which could not be irrigated have continued to grow well during the dry season and while not as good as the irrigated grass are still sufficiently good to warrant the planting of this crop where water is not available. It grows slowly during the dry season but quickly assumes its natural growth when the rains begin. On unirrigated land Guinea grass should be planted at the beginning of the wet season on well-drained land. It will then have sufficient time before the next dry season to acquire a complete root system. At the Trinidad garden Guinea grass grows fairly well during April, May, and June, but very slowly during the rest of the year. It does not appear to be adapted to the cool weather of this high altitude. Two hectares of Guinea grass have been grown at La Granja Modelo for forage rather than experimental purposes. On account of the unusually heavy rainfall this grass has done exceptionally well. Two fields of Guinea grass were fertilized, one receiving sulphate of ammonia and Japanese tankage in equal parts at the rate of 500 kilos per hectare, and the other an equal amount of "chemical sugar fertilizer." The result in both cases was a splendid revival of the grass.

Corn.—Three varieties of corn, including Mexican June and

two native varieties, *Kalapdos* and *Sagueril* from the Island of Siquijor, have been grown at Singalong. The Mexican June corn gives a good yield but the grain is very soft and is subject to the attack of weevils as soon as it is ripe. The *Kalapdos* variety gave a yield of 1,290.3 kilos (50.7 bushels) per hectare. It has a small ear with very hard grain that is not damaged by weevils. The *Sagueril* variety made a yield of 941.6 kilos (37 bushels) of poor corn per hectare on the same land and with the same care that other varieties have had, and was twenty-three days longer in maturing. Throughout the year plats of Mexican June and *Kalapdos* have been grown where they could not be cross-fertilized. The small plats were also planted with the varieties in alternate rows. The "crosses" obtained were very much like the pure Mexican June variety. At Lamao alternate rows of Mexican June corn and a native variety were planted in November. The rows of Mexican June were detasseled. The yield of the cross-bred rows was fair and many of the ears showed the flinty character of the native variety. Ten of the best ears were selected and planted separately for further selection. The object of this work is to get corn with the good bearing qualities of Mexican June and the flinty qualities of the native varieties. Work was also carried on with Mexican June corn for the purpose of increasing the yield and quality. Ten plats of 100 hills each from 10 selected ears were planted in July, 1910. Alternate rows were detasseled. Ten ears for the second planting were selected from stalks bearing two ears each in the detasseled rows and from the plat having the greatest yield. The plats in the first planting varied in yield from 15 to 75 kilos, with a total of 378 kilos. The plats in the second planting, which was made in November, varied in yield from 53 to 77 kilos, with a total of 642 kilos. This increase in yield may have been partly due to the fact that the second crop was given some fertilizer. At the Trinidad garden Mexican June corn grew and yielded very well during the dry season but very moderately during the rainy season. Corn has been grown at Alabang, La Granja Modelo and Ilagan, but for forage purposes rather than experimental work.

Pará grass.—Three plats of *Pará grass* growing at Singalong last year have been cut several times but no experimental work has been done with this grass. It has not been irrigated or cultivated but appears to be thriving. At the close of the year one or two of the plats of *Pará* appear to have become fairly rooted in an adjoining plat of *Paspalum*. One plat of *Pará* at the northern end of the station seems to have gained a decided ad-

vantage over the native weeds in the adjoining vacant lot for a distance of 1 or 2 meters and several healthy plants are well established among brambles and weeds at a distance of 5 meters from the original planting. One or two plants seem to be fairly rooted among *cogon*. It is noticeable that the stems of Pará grass have a tendency to lie on top of other vegetation, which of course retards its progress in forming new plants. It is probable that pasturing would aid in the establishment of this grass by pressing the recumbent stems to the ground. If this is true the inference is that with very little labor this grass could be successfully and profitably grown in pastures and out-of-the-way places now occupied by far less useful grasses. Pará grass at Singalong has, to date, resisted such drought and floods as have occurred, none of which, however, have been very severe. At the Trinidad garden Pará grass has grown quite well, giving a fair yield of forage.

Paspalum dilatatum.—Nothing has been done with this grass at Singalong except to cut it on one or two occasions when Guinea grass was scarce and the *Paspalum* especially tall. It is too short for satisfactory cutting and at Singalong there is no opportunity to pasture. It is noticeable that in one plat a native grass is gradually encroaching on the *Paspalum* while in other places Pará grass is making a similar encroachment. At the Trinidad garden *Paspalum* appears to be the most promising pasture grass that has yet been given a thorough trial. It does especially well during the rainy season.

Molasses grass.—This grass planted at Singalong in February germinated well but was of exceedingly slow growth. On May 26 some of the molasses grass was cut and fed to cattle and horses, which refused to eat much of it. More recently this grass has been fed regularly to two horses but up to the present time they prefer Guinea grass. After cutting, 50 per cent of the grass died. As yet no attempt has been made to cure molasses grass for hay. Seed of molasses grass was planted at Alabang in seed beds on March 13, 1911, but failed to germinate. On March 28 it was replanted and a few plants appeared. This failure to germinate was at the time supposed to be due to the destruction of the seed by a small species of red ant, as seed planted in April in boxes germinated perfectly in about five days. The seedlings thus obtained were transplanted to rows. Since that time the plants have grown but slowly. After several days of heavy rain in April a great deal of the seed planted in the seedbeds germinated, indicating that the seed did not have sufficient water when first planted. This grass has

not matured sufficiently to give any definite results in regard to its yield and feeding qualities. At the Lamao station molasses grass gave a dense, trailing growth which lodges badly. It has a strong odor and stock eat it very sparingly. When cut it does not send up a second growth readily and it does not cure well.

Tunis grass.—Planted in 3-meter rows it gave a good germination and rather slow growth. One row was cut when it had obtained a height of 1 meter. An attempt was made to cure the grass for hay, which was prevented by rains. The second row was left to mature seed. After the seed was harvested the grass was cut but it appears to be of little value.

Sudan grass.—This grass was planted both in drills and broadcast on February 18, 1911, at the Singalong station. In both cases it appears to have been planted too thick. That planted in drills was thinned out and the plants set in an additional two rows after cutting them back. They made a rapid growth and were cut during the latter part of May when about 2 meters high. The grass on this plot is now 1 meter high but not so vigorous as the first growth. The plot that was broadcast made a growth of $1\frac{1}{3}$ meters around the edges of the plot but not over two-thirds of a meter in the center. Recovery from cutting is slow. At the Lamao station Sudan grass produced tall, heavy plants 2 to $3\frac{1}{2}$ meters in height but too coarse for good forage. At the Alabang station this grass was sown on March 15 and 19, both in drills and broadcast. It was found that care must be taken not to seed too thickly. On both plots the crop is almost entirely free from weeds, the abundant foliage shading them out. Toward the latter part of April the grass began to head out and on May 28 the seed began to ripen. This grass could have been cut either for hay or for forage as early as the first of May but it was held over for the seed. Early in June a plot one-twentieth of a hectare in size was cut for hay. It produced at the rate of 11.2 tons to the hectare green weight and 5 tons when dried. The average height was 2 meters. This grass when fed green to horses and cattle is readily eaten by both.

Rhodes grass.—At the Singalong station this grass was planted on March 4, 1911, both in drills and broadcast. At the end of June that which was broadcasted had matured seed and was something over 1 meter in height. From June 18 to 30 daily cuttings were made for green forage. Recovery after cutting was good. This grass stands much better in drills than broadcast.

At Alabang Rhodes grass was seeded in rows on March 13, 14 and 15. Half of the plat was irrigated prior to planting and half subsequently. No difference in germination could be seen. The first seedlings were noticed on March 20. On April 14 part of the plat was transplanted. The transplanted roots appeared to do better than Guinea grass under similar treatment. It is considered essential that the transplanted roots be irrigated at the time of transplanting and twice later at intervals of three days. After this they may be handled the same as Guinea grass. On May 14 this grass, of the original planting, was waist high and had begun heading out. Rhodes grass, when planted from seed, matures in about six or seven weeks. Sufficient time has not elapsed since transplanting to state definitely when this will be ready to cut, but from general appearances it will take somewhat longer than Guinea grass, which requires about two months from time of transplanting. This grass lodges to some extent after a heavy rain. On May 28 this grass was cut for hay; it then had an average height of $1\frac{1}{2}$ meters and yielded 12,500 kilos per hectare green weight, or 4,190 kilos dry weight. When fed as green forage the animals eat Rhodes grass as readily as they do Guinea grass. As hay this grass appears to be equal to timothy. It has a clear, sweet odor and the horses eat it readily. At the Lamao station Rhodes grass seems to be the most promising plant grown for dry forage; it grows 1 meter in height, can be cut in six weeks with irrigation and cures easily. Rhodes grass at the Trinidad garden gave a tall, heavy growth and is one of the most promising grasses tried at this station. A small area cut on June 26 yielded at the rate of 44,559 kilos of green fodder per hectare.

Beggarweed.—At Singalong beggarweed was broadcasted on March 4 and a small cutting was made for green forage on May 26. The horses prefer Guinea grass. Recovery from cutting is doubtful. At the end of June the original planting was nearly 2 meters tall and had matured seed; the second growth was about two-thirds of a meter in height, very thick, and showed signs of seeding soon. Beggarweed was planted at Alabang on March 17 and was irrigated at the time of planting. The germination was almost perfect. It continued to do well until May 24 when several days of heavy rain occurred; after this a number of withered plants were noticed and on examination it was found that the roots of the affected plants had rotted away. This was particularly noticeable in the wetter portion of the field. On May 30 the seed was ripe and a small patch of it was cut and fed

to both horses and cattle. The horses ate it readily and when mixed with Guinea grass in all cases they picked out the beggarweed and ate it first. Only the leaves, however, were eaten, the stalks being rejected. The cattle, on the other hand, preferred sorghum and Guinea grass. When cut and fed with sorghum the whole mixture was quickly consumed. At the Lamao station beggarweed made a heavy growth of branching plants which were found to be fairly satisfactory for green forage.

Panicum hirsutissimum.—This grass planted on March 4 at Singalong appears to be much like Guinea grass, except that it has a recumbent stem and has been rather hard to establish.

Natal grass.—At the Lamao station this grass grew about 1 meter in height. It is comparatively fine in growth with dense, bushy clumps. Only a small amount was under observation and a further trial will be necessary for conclusive results.

Velvet beans.—Two hills each of 16 varieties of beans were planted at Singalong on March 16. All of these beans are on bamboo trellises 3 to 4 meters apart. One variety is particularly promising and it appears that several of the other varieties will give good results. At Lamao the same 16 varieties of beans were planted as at Alabang but none of them made a satisfactory growth.

Lyon beans.—At Lamao, Lyon beans planted in an old rice field, with no cultivation and no irrigation, made a very vigorous growth, covering the ground well and keeping down foreign growth. About 2,000 kilos of dry pods were obtained.

Cowpeas.—New Era and Clay Colored were planted at Lamao and made a fair growth; the New Era proving much the better of the two. It is a semi-climber with pods about 10 centimeters long and brownish beans, and is greatly superior to the native *sitao* in earliness of bearing and in yield. A field of 1,200 square meters planted on November 14 began bearing on December 30 and gave a total yield of 100 kilos of dry beans. Planted about 60 centimeters apart they made a dense mulch and are excellent both for a cover crop and for food. Cowpeas planted at Alabang have done fairly well though somewhat affected by rust and aphids.

Miscellaneous forage plants.—At Alabang, Colorado grass planted in March grew slowly and very poorly. This grass does not compare with either Guinea grass or Rhodes grass. Shabdar clover gave unsatisfactory results. At the Lamao station Colorado grass produced a small light growth about 90 centimeters in height. Mexican clover, a low almost creeping

plant, began producing small white blossoms when only a few centimeters high and appears to be of little value. At the Trinidad garden oats grown as cover crop during the rainy season gave a fair yield of forage. Sorghum has proven to be one of the best forage crops at this station. Alsike clover grown as a cover crop during the rainy season gave a satisfactory growth. Common red clover, sown extensively as a cover crop, gave a good stand and is one of the best cover crops tried. Kentucky blue grass was planted but failed to germinate. Siberian millet germinated well but quickly succumbed to the effect of heavy rains. Perennial rye gave a good growth and is also promising. Orchard grass gave results similar to perennial rye and is considered promising. Italian rye grass gave a tall, heavy growth. Fescue grass failed to germinate. Shabdar clover gave a good stand of rather slow growing plants. All of the legumes grown at the Trinidad garden have been found to be well supplied with tubercles.

HORTICULTURE.

The horticulturist, Mr. P. J. Wester, arrived in Manila on March 13, 1911, and reported for duty on March 14. He has begun a classification and study of the native fruits, vegetables, legumes, nuts, and root crops of the Islands. During the remainder of the fiscal year he visited twenty-one provinces and brought together a considerable number of varieties of fruits not heretofore studied in the Philippines. Photographs are being made and records kept as to measurements, weights, etc., of the principal fruits, such as the mango, citrus fruits, and avocado. In connection with the entomologist he has investigated several insect pests of the mango and citrus fruits and articles pertaining to these investigations have been published in the REVIEW. Nurseries have been started at the Singalong experiment station for the propagation of promising citrus, mango, and avocado varieties.

Mangos.—Work has begun on “topworking” old mango trees, which for unknown reasons are unproductive, with the object of budding these trees to standard varieties which are known to be normally productive. On a mango plantation having 1,400 trees at Muntinglupa, Rizal Province, experiments have been instituted and a careful study of the types of seedling mangos there in evidence is being made. A horticultural census taken in this mango orchard disclosed the rather astonishing fact that only 8 per cent of the trees bore an abundant crop and 15 per cent a good crop, while 28 per cent had a poor crop

and 49 per cent of the trees were unproductive, i. e., 23 per cent, or less than one-fourth of the trees, yielded a satisfactory return. This grove being the largest, and probably one of the best, in the Islands, it is fairly safe to assume that less than one-fourth of the mango trees in the Philippines are giving what a fruit grower would be justified in calling economic returns. By the comparatively simple methods of "topworking" and budding these unproductive trees, it is practically certain that within three years the mango crop of the Philippines could be not only standardized as to varieties but increased fully 100 per cent. It is estimated that in some districts fully one-half of the mango crop is lost through pests.

Bananas.—At the Lamao experiment station experimental work has been carried on with the following named varieties of bananas to test methods of culture and cost of production: *Matabia*, *lacatan*, *gloria*, *Chinese dwarf*, and *saba*. Six plats of 90 plants each, three of them with 30 additional plants of Chinese dwarf, were planted on May 31, 1910.

Papayas.—A plat containing 393 Hawaiian papaya trees was set out at the Lamao station on July 9, 1910. They proved very variable and the poor ones were cut out from time to time so that on June 30, 1911, there were 184 female and 35 male trees left. The first fruit ripened on March 27, 1911, about nine months after setting. About 8 kilos of seed have been secured.

Pineapples.—Of the varieties planted at Lamao on July 2, 1908, namely; Natal canning, Cuban queen, sugar loaf, maladuge, and red Spanish, only one variety, the Natal canning, is considered to be worth propagating. It bears fruits averaging 1 kilo in weight, 10 by 14 centimeters in size, smooth, nearly as large at the top as at the bottom, with very shallow cavities, and an almost entire absence of fiber and very little acidity. In appearance it resembles the Hawaiian variety grown here but has less fiber and acidity. Sugar loaf averaged 1 kilo in weight, 11 by 11 centimeters in size, tapering at the top, medium acidity, deep cavities and fibrous flesh. In some of the fruits the sections rotted on the inside before fully ripening. Maladuge averaged three-fourths of a kilo in weight, 9 by 12 centimeters in size and resembles the common native variety in shape and manner of growth. Red Spanish is rather acid and of poor quality. Cuban queen made a very poor growth. The fruits were very small and poor in quality.

Citrus fruits.—The pomelos and Lisbon lemons planted in

August, 1906, at Lamao are making a vigorous growth. The pomelos are 3 to 4½ meters in height but show no signs of bearing. The lemons have borne only a few fruits, which are of fairly good quality and turn yellow when ripe.

Avocado pears.—The trees set out at Lamao on September 15, 1905, are vigorous and healthy, average 4 to 5½ meters in height, but as yet show no signs of fruiting. The avocado pear tree at the Singalong station, which matured 16 pears last year, this year bore about 150 fruits.

Miscellaneous fruits.—Three varieties of roselle (*Hibiscus sabdariffa*) have been introduced and distributed to some extent. It is believed that the introduction of roselle into the Philippines will be a valuable addition to our fruits. Seeds of cherimoya (*Anona cherimolia*) and hybrid seeds of this species and of *Anona squamosa* were brought to the Philippines from Florida and a number of the seedlings are now growing at Singalong and Lamao. Stockplants of *Anona muricata*, *Anona squamosa*, *Anona reticulata* and *Anona glabra* are being grown at Singalong and Lamao to be used in the prospective importation of "large-fruited" cherimoyas from Australia and America. At the Lamao station experimental work is under way with a collection of 28 different native fruits and a number of different introduced fruits. Peach trees planted in 1906 blossomed fully during the past year and one tree has set a number of fruits. At Trinidad garden strawberries are now an important crop; nearly a hectare was grown this year. They commenced bearing December 20 and continued bearing until the end of the fiscal year. The most abundant yield and the best fruit was obtained during January and February. This is the most profitable crop grown at Trinidad, the sale amounted to ₱2,929.20 and during January hundreds of kilos of ripe fruit were not picked because of lack of buyers in Baguio. Mulberries have continued to grow rapidly and have yielded a fair amount of fruit. Blackberries and loganberries have been a failure.

Vegetables.—Commercial vegetable gardening has been carried on at the Trinidad garden, the best results having been obtained with beets, cabbage, kohlrabi, radishes, and turnips. Beans and peas did well in the dry season. At the Lamao station a large collection of both native and introduced vegetables are being grown for experimental purposes. The best results have been obtained with squashes, cucumbers, eggplant, tomatoes, okra, batao, mungo, and condol. White radishes and pechay also do well but produce very little seed.

FIBERS.

The fiber expert has spent the larger part of his time on lecture and investigational work in the provinces and in the preparation of exhibits for different fairs and expositions. During the latter part of the fiscal year the most complete fiber exhibit that has ever been collected in these Islands was prepared by the fiber expert and taken by him to the Fiber Congress at Surabaya, Java.

Abacá.—The only station of the Bureau at which abacá is grown is La Granja Modelo in Occidental Negros. As laborers could not be obtained who were willing to strip the abacá on any terms other than for daily wages, and as this would have cost about the full value of the product no fiber has been produced this year, except some small samples for exhibition purposes.

Maguey.—The 20,000 native maguey plants and the 5,000 sisal plants at the Lamao station have made a good growth and now have leaves $1\frac{1}{2}$ to 2 meters in length. Under conditions existing at this station the cleaning of maguey by *retting* has been found to be unprofitable. No attention is being given this crop at present.

Cotton.—Silk, wool, and alpaca varieties of Caravonica cotton were planted at Lamao on November 26, 1910. The wool variety did not germinate; the silk variety is now 160 to 240 centimeters in height with bushy, vigorous plants; the alpaca variety is 150 to 200 centimeters in height. The two latter varieties began blooming about the middle of February but produced no bolls worth harvesting.

Kapok.—Dahomey kapok, variety No. 1, planted on August 9, 1910, has made a good growth 3 to 4 meters in height and has a very spiny trunk; variety No. 2, planted December 9, 1910, is looking well, is 100 to 120 centimeters in height and has a smooth trunk. Native kapok planted in 1908 in a cogon field has nearly all died. That along the fence and by the roadways where it has received some cultivation has made a good growth and a few of the trees bore as high as 100 pods each this year.

MISCELLANEOUS PLANTS.

Rubber.—In January, 1911, about 120,000 seeds of Pará rubber were obtained from Singapore. The larger part of these seeds were planted at the Singalong experiment station, the remainder being sent to La Granja Modelo and to the quarantine station at Iloilo. About 35,000 plants were obtained from the lot planted at Singalong, about 1,200 at La Granja Modelo and about 750



PLATE III.—PARA SEEDLINGS IN BAMBOO TUBES, SINGALONG EXPERIMENT STATION.

at Iloilo. The germination of the seeds was approximately 30 per cent. The seedlings at Singalong are being sold at the rate of ₱3 per hundred, whereas those at La Granja Modelo and Iloilo are being distributed *gratis* in small lots to applicants. The old Ceara trees at La Granja Modelo were tapped during the month of December and samples of the rubber prepared therefrom were exhibited at the Bacolod Exposition and at the Manila Carnival.

Coffee.—At the Lamao station 230 plants of Liberian coffee set out in 1906 are in healthy condition and are about 2 meters in height. One hundred and forty-four plants of choice “robusta” from Java set out in 1909 have made a very vigorous growth and are now 130 to 180 centimeters in height with bushy tops. When one and one-half years old the trees bloomed abundantly. There is a good crop of berries about one-third grown at the present time. In appearance this variety resembles the Liberian. Twelve trees of Arabian coffee, planted in January, 1909, have made a poor growth; they are now 80 to 90 centimeters in height with bushy tops and have produced a few blossoms but no fruit. Thirty trees of Hawaiian coffee set out in June, 1910, have made a healthy growth and now average 1 meter in height. Thirty-six trees of Lavarian coffee planted in November, 1909, have made a healthy, bushy growth and are now 120 to 140 centimeters in height. They have not blossomed. Twelve trees of native calinog coffee planted in June, 1911, are looking well and are about 40 centimeters in height.

Sugar cane.—A number of varieties of Hawaiian cane have been received and planted at the Alabang stock farm. These canes, especially numbers H. 27, H. 309, and H. 227, have done very well. A considerable quantity of canes from the propagating plat have been sent to La Granja Modelo for trying out. A variety of Japanese cane has been recently introduced from California to be used as forage.

Cacao.—At the Lamao station 20 plants each of *Forastero* and *Caracas*, planted in July, 1909, have made a very poor growth averaging only 60 to 140 centimeters in height. Trees of the red and white varieties planted in 1908 have never borne fruit and have made a very poor growth.

Mulberry.—About 500 mulberry cuttings planted in July, 1908, at Lamao, have made an excellent growth and are now in good condition. Nearly 100,000 cuttings were distributed during the fiscal year ending June 30, 1910, and 20,700 during the past fiscal year. At present there are about 50,000 cuttings available for distribution.

Annatto.—At Lamao two plats of 36 plants each, one cultivated and the other on uncleared land without cultivation, were planted in November, 1909. The cultivated plat has made a vigorous growth and the plants are now 130 to 170 centimeters in height. The other plat has made a spindling growth with plants 100 to 130 centimeters in height.

Camotes.—Twelve varieties, secured from the Guam experiment station, were planted at Lamao in November, 1910, and have all made a fair growth. Only a small number of each variety were secured and a further trial will be necessary for a fair comparison.

Forest trees.—A tree nursery has been started at the Alabang stock farm with the idea of supplying legume and other trees for a test in reforesting cogon hillsides. In this nursery are planted a number of new varieties of trees from India, Australia and other parts of the world. Among the most useful of these may be mentioned a species of "mesquite" (*Prosopis juliflora*) imported from the Hawaiian Islands where the seeds and pods are largely used in the form of a meal for cattle feed. A special effort will be made to establish this tree on the poor soils of the Alabang hills, the idea being that the pods will furnish considerable feed for the live stock in the pastures while the trees will both benefit the soil and serve as windbreaks. There are also, in this nursery, several species of Australian gum tree (*Eucalyptus* sp.) and of Australian wattle (*Acacia* sp.), all of which give promise of successful growth here. The Bureau of Forestry has supplied a number of varieties of native trees, the majority of which are in a thriving condition.

SEED DISTRIBUTION.

The amount of garden seeds distributed during the year has been somewhat less than that of the previous year, as the Bureau of Education now supplies seeds for its provincial schools, whereas formerly this Bureau furnished seeds to such schools. However, 4,942 allotments of vegetable seeds, each collection containing about 10 separate packets, were distributed. Five hundred and sixty-one collections of flower seeds, 50 packages of ornamentals and miscellaneous seeds and several hundred packages of various legumes, abacá, kapok, fruits, etc., were sent out. One thousand, six hundred and seventy-eight kilos of Mexican June shelled corn and 11 sacks of corn in the ear were distributed. Other distributions of seeds and plants include 2,000 selected cacao pods, about 400 packages of papaya seeds, 400 pineapple suckers, 20,000 mulberry cuttings, 2,000 maguey suckers and about 1,200 maguey bulbils.

ENTOMOLOGICAL INVESTIGATIONS.

During the year the entomologist carried on investigations relative to plant pests—including locusts, insects, and rats—in 27 provinces. Particular attention has been paid to pests of sugar cane, coconuts, and fruits, although garden vegetables, bananas and other crops have received considerable attention. One hundred and five reports relative to pests affecting the various crops of the Archipelago have been received; 68 of these reports dealt with locusts, 12 with rats, and 6 with sugar cane.

In connection with the locust work the original law has been amended so that it is much more effective, and this together with circular letters sent out from time to time from the Executive Bureau at the request of this Bureau, have brought home to the local planters the fact that the locust pest may be greatly mitigated by proper methods and that coöperation in the work is necessary. During the past year locusts have been reported from something over 100 municipalities and barrios. The infestation area seems to be in a V-shaped region extending from Ambos Camarines through Masbate to Cebu and Bohol, then back through Negros, Iloilo and Capiz to Romblon. The insects, as reported, move from the southwest toward the northeast, being influenced more or less by the direction of the prevailing winds.

In the Province of Iloilo more than 200,000 cavans of young locusts were reported destroyed during the months of August, September and October; no sprays were used in this work, the antiquated driving method only being used. It was demonstrated at the Alabang stock farm, however, that a single spraying with sodium arsenate was effectual even in cogon grass.

From circular letters sent to the governors of the affected provinces, it has been possible to determine (1) The areas of greatest infestation; (2) the time of appearance and stages of the insects; (3) the direction and extent of movement of the swarms; (4) the equipment on hand, or required, for each province; (5) the proper points for establishing distributing stations for equipment when necessary. It is proposed to have constantly on hand in every district liable to be affected by locusts a supply of galvanized iron sheets for use in the popular method of driving the young insects.

If the policy of obtaining detailed reports from every district liable to infestation be carried out carefully, this Bureau will be enabled to determine with a fair degree of certainty the districts in which operations against the pest will be necessary and the extent to which outside assistance should be given, and

also to forecast the dates of expected outbreaks, and the probable routes of flying swarms.

During the latter half of the year a special study of the cigarette beetle has been made, both in the laboratory of the Bureau and in the tobacco factories of Manila. It is estimated that more than ₱200,000 damage is done to stored and manufactured tobacco in Manila or in export shipments therefrom, caused almost entirely by a species of *Lasioderma*. While a tremendous amount of damage is caused in the fields by the tobacco aphid, stemborer (*Chloridea obsoleta*), cut-worms, bud-worms (*Prodenia littoralis*), etc., and in the warehouses by the tobacco moth, the cigarette beetle is the principal pest which the tobacco dealers have to contend with in the Philippines.

Both refrigeration and fumigation, and a combination of the two methods, have been tried by several of the tobacco manufacturers of Manila. It appears that the freezing method has some value but is inadequate to destroy all eggs in the manufactured tobacco and a considerable percentage of the adult insects escape; fumigation with formaldehyde is inadvisable, but it remains to be seen whether in an ordinary factory carbon bisulphide is better than potassium cyanide as a killing agent. While each method has its advantages, it is believed that cyanide gas will be the more effective agent, when intelligently handled.

The great economy of the fumigating process is now appreciated by most of the manufacturers, although less than six months ago but little work had been done along this line in the Philippines. It is estimated that chemicals for the cyanide method costing less than ₱1 will serve to completely destroy all beetles and their eggs contained in 20,000 cigars or in a corresponding bulk of cigarettes: and carbon bisulphide, costing about ₱1 (1 kilo), should fumigate about five times this number of cigars. Some of the principal manufacturers have been advised in reference to improved systems of storage of the raw product, to insect-proof flooring, and to other improvements in the practical handling of both the raw and manufactured product. Within six months it is hoped the details of the fumigation processes in question will be worked out. It will be necessary for the manufacturers to use some sort of fumigation for at least a year or more before the pest can be eradicated. Material for a circular on the subject is in hand.

Serious losses are suffered from rats in cane and coconut districts, such as Pampanga, Batangas, La Laguna, Ambos Camarines, Samar, and Marinduque. Arsenic has been distributed to several planters in these districts, but until further experiments



PLATE IV.—IMPORTED NELLORE BULL AND COWS.
Property of the Bureau of Agriculture.

are made in trapping and poisoning, this pest will probably remain a very serious one and practically uncontrollable by any ordinary means. Investigations are under way to determine the most economic means of reducing the ravages of rats. It appears that at least 3 and probably 5 species of rats are concerned with cane and coconut damages; very little is known concerning the life history of these species.

In some of the mango districts insect pests reduce the crop more than one-half. The principal pests of the mango are the so-called "leaf-hoppers" (*Idiocerus* sp.), which attack the flower panicles, sucking the sap from the pedicels and thus weakening the minute fruits so that they drop off; a web-worm is common, but apparently does little damage to the crop; a fruit-fly, similar in habits to the Mexican fruit-fly (*Trypeta ludens*) does considerable damage to immature fruits in Luzon. In November a twig-borer was noted in mango trees at Santa Mesa; a similar, or identical pest has been noted near San Francisco, Cavite.

Little or no progress has been made with coconut insect pests. A species of *Coccidæ*, attacking the young nuts and flower stems of coconuts at Guiljungan, Oriental Negros, was noted, and a leaf scale was found to be abundant at Jaro, Iloilo.

Little work has been done on rice insects during the year, but it is proposed to follow a more detailed investigation of the rice-bug and stem-grub during the coming year.

Two maize pests have been observed, one attacking the stem by boring into it, and another, probably the tobacco leaf caterpillar (*Chloridea obsoleta*), attacking the developed ears.

A new citrus pest has been observed which is a small moth found defoliating the trees at Cagayan, Misamis. A small moth deposits its eggs on or in the rind of immature pomelos, the larvæ entering into the rind and causing unsightly blemishes on the mature fruits; this apparently attacks only the larger citrus fruits. Larvæ of a species of *Papilio* were noted attacking lemon trees at Daraga, Albay.

A bag-worm has been found attacking the bananas in several localities; the banana leaf-roller has been carefully studied and found to be well parasitized by one *Dipteron* and at least three species of *Hymenoptera*, one of the latter insects identified as a new species (*Chalcis thracis* Crawford) by the Bureau of Entomology, United States Department of Agriculture.

Sugar-cane insects have been studied at several points, especially at La Granja Modelo. It appears that a root beetle (*Holotrichia vidua*) is the most serious cane pest in the Philippines, in some areas temporarily necessitating abandonment of the

field. A red weevil (*Sphenophorus*) has been noticed in Negros canes. A woolly aphid (*Oregma lanigera*) is troublesome in some areas and a fulgorid (*Phenice moesta* Westw.) has been noted on cane in Occidental Negros.

At Misamis a very severe case of mistletoe parasitism on citrus trees was discovered by the entomologist; in some cases it seemed to be actually killing the trees.

The cabbage butterfly (*Pieris* sp.) has been more or less troublesome in cruciferous crops throughout the Archipelago; at the Trinidad garden hand-killing was tried with considerable success.

EXPERIMENT STATIONS.

On July 1, 1910, for administrative purposes, the work of the experiment stations and that of plant industry were organized as separate divisions. The operations of these two divisions are so closely allied, however, that it has seemed desirable to include under the general subject of "plant investigation" in the report of the division of plant industry a considerable part of the work done at the experiment stations.

GENERAL INVESTIGATIONS.

On October 15, 1910, Mr. O. W. Barrett, the chief of this division, reported for duty. During October visits of inspection were made to the Lamao experiment station and to the Tanauan and Lipa districts in the Province of Batangas. The Batangas inspection was for the purpose of selecting a site for a permanent experiment station.

In November visits were made to the Agricultural College at Los Baños and to the coconut districts of Santa Cruz, Majayjay, Lilio, and Pagsanjan in Laguna Province. The Alabang stock farm was also inspected with the object of outlining future plant industry work at that farm. During the latter part of November and the first half of December a trip was made to Iloilo, La Granja Modelo at La Carlota, Occidental Negros, and the Camp Vicars potato farm in Mindanao. During the latter part of December an inspection was made of the Calauan estate near Bay, Laguna Province, and a second inspection of the Tanauan district.

Early in January an inspection was made of the Trinidad garden and the Trinidad stock farm in the Province of Benguet. From February 2 to 14 a trip was made to Zamboanga for the purpose of giving lectures on rubber and coconut culture at the industrial exposition held at that place.

On March 2 a second inspection was made of the Lamao experiment station and during March trips were made to Lipa and Santo Tomas, Batangas Province. From March 16 to April 7 a trip was made to the Cagayan Valley for the purpose of inspecting the tobacco station at Ilagan. Several stops were made along the Cagayan River in the more important tobacco sections of that district. From April 15 to May 11 a trip was made to the Visayan Islands and to northern Mindanao for the purpose of general plant investigations. On May 29 and 30 the Luisita Estate at San Miguel, Tarlac, was visited with the object of planning rice work and forage experiments to be carried on at that place.

SINGALONG EXPERIMENT STATION.

The Singalong station, located in the city of Manila, is used principally as a receiving station for live stock handled by the Bureau in Manila, as a headquarters for transportation used by the Central Office, and for the growing of Guinea grass and other forage crops.

Supervision and labor.—This station has been under the supervision of Mr. W. H. Birch for the entire year. The average amount of labor used has been 22 men per day. The average daily wage paid this labor has been ₱0.909, and the total amount paid for labor ₱6,286.28.

Climatic conditions.—The weather conditions throughout the entire year were ordinarily favorable although some losses resulted from heavy rains which occurred in October and November. These losses, however, were more than compensated for by several rains which occurred during the dry season.

Fertilizers.—The station has used no chemical fertilizers during the year, the manure from the stables being sufficient for all of the crops and nurseries.

Pests.—One crop of corn (on a plat which had grown 5 crops during the previous nineteen months) was damaged considerably by the corn moth (*Pyrausta vastatrix*). White ants and wood borers damaged timbers in the buildings to some extent. Considerable damage was done by weevils in stored seeds and grain.

Crops.—The principal crops grown at Singalong during the year have been Guinea grass, corn, rubber and miscellaneous fruits and forage plants. About 75 varieties of economic and ornamental trees and shrubs are growing on the station grounds. Guinea grass roots, pineapple suckers, banana suckers, sisal plants, and cuttings and seeds of ornamentals have been distributed throughout the year from this station.

LAMA O EXPERIMENT STATION.

Supervision and labor.—The Lamao station has been under the supervision of Mr. O. B. Burrell for the entire year. Mr. Silverio Apostol, agricultural assistant, was in charge of the rice tests from April to December, 1910, and was again assigned for similar work in June, 1911. During the greater part of the year a sufficiency of labor has been obtained without difficulty at a wage of ₱0.75 per day. The total labor payrolls for the year, including the *capataz*, amounted to ₱3,631.04.

Climatic conditions.—The weather conditions have been exceptionally favorable. The rains were quite evenly distributed throughout the year, several good rains coming during the dry season.

Fertilizers.—Fertilizers to the value of ₱102.71 have been used, the greater part of this amount being for nitrate of soda (390 kilos) and tobacco waste (420 kilos).

Pests.—Comparatively little damage has been done by pests. Insects infesting the flowers of *cadios* were destroyed by spraying with lead arsenate. The same spray, however, had no appreciable effect on an apparently new pest attacking the buds and very young fruits of tomatoes.

Crops.—The principal crops grown at this station during the year have been upland rice, both native and introduced fruits and vegetables, coffee, and miscellaneous forage plants.

TRINIDAD GARDEN.

The Trinidad garden is located at Trinidad, subprovince of Benguet. Experimental work having been largely discontinued at this station, it is now used for commercial gardening and for the production of forage for the Trinidad stock farm.

Supervision and labor.—The Trinidad garden has been under the supervision of Mr. M. S. Haskell, agricultural inspector, for the entire year. The average number of laborers employed has been twenty-five; with the exception of one Japanese, the labor is about evenly divided between Ilocanos and Igorotes. The average daily wage was ₱0.655, or, excluding the *capataz*, ₱0.626, per day. The total amount of the labor payroll was ₱5,300.75.

Permanent improvements.—Among the more important improvements at this station during the year were a party-line telephone, a four-room dwelling house for laborers and an open wagon shed.

Climatic conditions.—The weather conditions have not been very favorable. One severe typhoon occurred on September 24, 1910. The dry season was longer and more severe than that

of the two preceding years. The total rainfall for the year was 3,653.79 millimeters (143.85 inches), which was considerably less than that of the preceding year. The extreme range of temperature was from 7.5°C to 33.5°C.

Irrigation and fertilizers.—The irrigation of crops was carried on between September 7 and April 20. There was at all times an abundance of water both for the station and for the local farmers in the valley. On account of the very heavy rainfall the soil at the station requires continual fertilizing. As very little manure is produced at the station the main dependence must be placed upon mineral fertilizers, though the chief need of the soil appears to be *humus*. A large quantity of tobacco waste has been applied to the strawberries, both for its fertilizing and insecticidal value.

Crops.—The strawberries proved the most profitable crop grown, the sales amounting to ₱2,929.20. During January, however, hundreds of kilos of ripe fruits were lost through lack of demand. Excellent results were also obtained with beets, cabbage, kohlrabi, radishes, and turnips. Beans and peas did well in the dry season. Tomatoes failed on account of a fungus disease apparently introduced from Australia with the seeds. The forage crops have done fairly well, especially Rhodes grass and *Paspalum dilatatum*. A large variety of legumes and grasses are being tested.

The total receipts for this station were ₱7,104.74, which amount exceeds the total of the pay rolls by ₱1,803.99. A considerable amount of forage was produced at this station and delivered at the Trinidad stock farm. The value of this forage, however, is not reckoned in the produce accounts. Unfortunately the "Baguio season" and the crop growing season at the Trinidad garden do not coincide very closely, otherwise the receipts from vegetable sales would be largely increased.

LA GRANJA MODELO.

This farm, which was established by the Spanish Government as an experiment station for work with sugar cane, is located at La Carlota, Occidental Negros. It is operated in a small way for the commercial production of sugar; is used for experimental work with sugar cane, grasses and other plants; and during the past year it has also been used as a stock farm.

Supervision and labor.—This farm was under the supervision of Mr. R. E. Burris from the beginning of the fiscal year until October, 1910, when he was relieved by Mr. H. J. Gallagher. There has been a shortage of labor throughout the year and the

quality of the labor has been inferior as compared with previous years. At least 20 per cent more laborers should be employed during the harvest and milling season than have been employed during the past year. On account of the impracticability of following the usual custom of advancing money to laborers before they begin work it was found necessary to increase the wage of the field men from ₱0.50 to ₱0.60 per day. Previous to December, 1910, ordinary field men were paid ₱0.50; extra good men, those caring for the horses, received ₱0.60 per day.

Climatic conditions.—The fiscal year covered by this report was one of unusual rainfall in the La Carlota district, particularly during the months from December to April. During this period, which is usually comparatively dry, about 431 millimeters (17 inches) of rain fell. The total rainfall for the year was 2,669.8 millimeters (105.11 inches).

Water supply.—During the dry season this farm has not enough water for irrigation purposes unless the three sugar mills located on the stream below the station are more or less deprived of their necessary quota of water power. From June to November water could have been taken from the Najalin River to irrigate several hundred hectares of rice land. With a reservoir in which water could be stored during the night a sufficient supply of water would be available during the day time without discommoding the down stream sugar mills. Without such a reservoir extensive irrigation is impracticable.

Permanent improvements.—During the year the dwelling house of the superintendent, the fuel shed and the sugar mill have been repaired, and a house for the stable foreman, four concrete culverts and wire fencing have been constructed.

Fertilizer experiments.—In January 4,600 kilos of fertilizers were donated to this station by a commercial firm in Manila for experimental work. The greater part of this fertilizer has been used during the year. As the donators were very anxious to have the fertilizer used immediately the greater part of it was applied to plant canes. The results thus far obtained, naturally, have been unsatisfactory. This is largely due to the fact that the fields in which the experiments were made are rich in plant food and are maintained in excellent tilth. Very satisfactory results were obtained from the application of fertilizers on plats of Guinea grass.

Pests.—During July and August, 1910, the farm was visited by several swarms of locusts which deposited their eggs in the neighborhood. When these eggs hatched it required the entire farm force to destroy the young hoppers, this work costing about

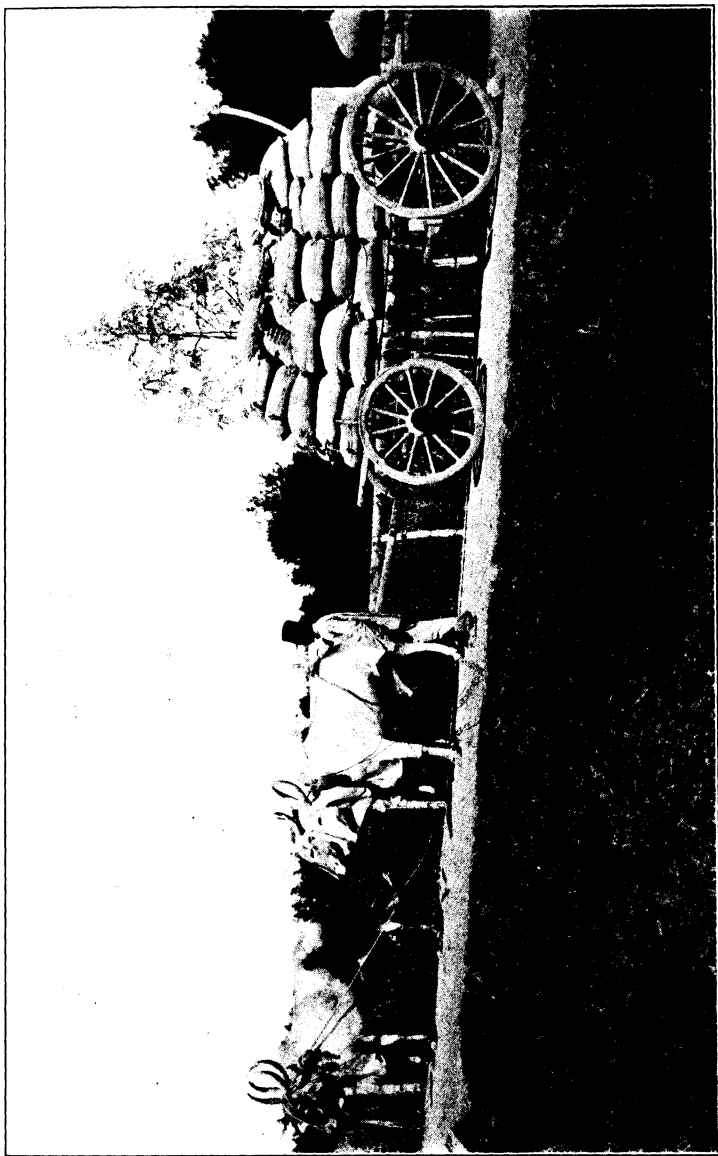


PLATE V.—IMPORTED NELLORE BULLOCKS.

₱100. Since September there have been no locusts in the district.

The cane root beetle severely damaged a few hectares of cane. This pest is apparently confined to several areas where the soil is very loose. Some of the infected areas have been abandoned but appear to be as badly infected even after several years as they were when cultivation was first discontinued.

At least one species of cane borer attacked the cane, not causing any great loss, yet doing sufficient damage to demand careful investigation during the coming year. This borer seems to be confined to the imported cane, especially the striped Louisiana variety.

Crops.—The principal crop at this farm is sugar cane. Other crops grown are Guinea grass, rice, corn, sisal, abacá, rubber, and miscellaneous forage crops.

During the planting season some 28 hectares were planted in cane, about half being native varieties and half Hawaiian canes. This, with the ratoon fields, will give approximately 40 hectares for the ensuing crop. About 12 hectares of the plant cane were planted sparsely with corn at the same time. The object of this was to prevent the cane from growing too rank and also to produce grain for the live stock.

BACOLOD EXPOSITION.

The farm sent the following exhibit to the Agricultural and Industrial Exposition held at Bacolod from December 30, 1910, to January 4, 1911: Four head of Nellore cattle, 2 Berkshire boars, samples of 6 varieties of sugar cane, 1 sample of sisal fiber and 1 sample of Ceara rubber. This exhibit was awarded a "bronze medal of honor" and the municipality of La Carlota, materially assisted by this contribution, was awarded the "first municipal agricultural prize." The live stock exhibit attracted a great deal of attention as evidenced by the many inquiries regarding live stock received by the superintendent since that time.

ILAGAN TOBACCO STATION.

The Ilagan tobacco station, located at Ilagan, Isabela Province, was established for the purpose of conducting experimental and demonstration work with tobacco. This station also serves as a headquarters for agricultural extension work carried on in the Cagayan Valley.

Supervision and labor.—This station was under the supervision of Mr. Charles A. Mahan from the beginning of the fiscal

year until March 30, 1911, when he was relieved by Mr. R. W. Rowe. In accordance with the project for carrying on tobacco work in the Cagayan Valley outside of the station grounds, two Filipino inspectors were secured during May, 1911. It has been found necessary to discharge one of these inspectors, but the other one is doing good work. The principal duty of the inspectors at present is to instruct the local planters how to properly save and sow tobacco seed on their plantations. There has been considerable difficulty in securing sufficient labor even for the small area of ground under cultivation at this station. The labor is of low grade at best and certain local customs which the station can not adhere to render the employment of permanent labor a precarious matter.

Permanent improvements.—A large store house, at present used for storing implements, has been built during the year. On April 1, 1911, work was started on a building to be used both as a residence and office for the superintendent. This building was not entirely completed at the close of the fiscal year.

Crops.—During Mr. Mahan's tenure about 2 hectares of the best land at the station was cleared, fenced and put under cultivation. Two fields of tobacco were set out, one of 8,150 square meters, the other of 8,639 square meters. About 700 tobacco plants were selected for seed and these were bagged and tagged, each type being kept separate. This seed was cleaned and will be used the coming season in continuing tests of local tobacco types.

A field of corn has recently been planted and tests of several legume crops are being made.

MACHINERY AND BUILDING DIVISION.

Forage factory.—The work of the forage factory during the past year has been largely in the handling, curing, storing, and preparation of corn in various combinations with other feeds to form a grain mixture to be used as a substitute for oats. Corn is the only grain grown in the Philippine Islands, outside of rice, which can be obtained in the large commercial quantities required in the manufacture of forage. The greater part of the crop of corn grown in the vicinity of Manila matures during the months of July and August. This is in the midst of the rainy season and the corn must be handled in the ear, as the fresh shelled corn will ferment and heat in a short while unless thoroughly dried.

The forage factory has been without proper storage facilities, but secured the use of one of the cattle sheds in the stockyards, in which the ear corn purchased was stored to a depth of 2 meters

on a concrete floor; when thoroughly dry it was shelled and stored in an almost air-tight bin, 3 meters square and 5 meters deep. A bamboo, with perforated joints, was inserted vertically in the center of the bin and carbon bisulphide introduced through this opening, with a view to killing the weevils which had attacked the corn while curing in the shed. The weevil is the greatest enemy of stored corn in the Philippines and its effective control is a problem deserving considerable attention.

The experiences of the past year show that it will be necessary to provide a lot of large iron tanks, holding from 20 to 50 tons of shelled corn, and so construct them that they will be proof against the invasion of weevils and moisture. They can be provided with a manhole at the top so as to be filled from a chain carrier and a grain chute at the bottom from which the corn can be taken out, and will probably require perforated pipes through which a hot-air blast can be driven for drying out corn received before it is fully cured.

During the year the factory has prepared 706 metric tons of grain feed which was disposed of for ₱48,883.89, or a little less than ₱70 per ton. Six hundred and forty tons of this amount consisted of the grain mixture containing from 50 to 60 per cent of ground corn and 50 tons of pure corn meal. The expenses of the forage factory during the year, for maintenance, operation, and materials, were ₱47,310.58, which gives a small profit over its operation. This forage was used principally by the Bureau of Agriculture in feeding the farm animals, by the city of Manila for feeding its draft stock, and by the quartermaster's corral at Pasay in the feeding tests conducted by the forage board.

Permanent improvements to the value of ₱6,589.03 were made at the factory during the year. These consisted principally in the installation of an 80-horsepower tubular boiler, a 50-horsepower engine, and a small amount of tramway track and cars for handling the forage products. A small addition was also made to the machinery by the installation of additional corn mills, shellers, a mixer, and an ensilage cutter.

It has proven impracticable to secure a green fodder of any kind at prices low enough to warrant curing same by artificial heat for the production of hay. The greatest success has been attained in encouragement of corn growers in the hand-stripping and curing of corn-blade fodder. However, it is doubtful if this can be shipped from the provinces to the forage factory to be cut, baled, or otherwise processed, at a cost lower than imported hay of an equal grade. The probabilities are that this branch

of forage production can be carried on best by the individual farmer stripping, curing, and baling the corn fodder on his farm and selling it direct to the dealer or consumer, without incurring further expense.

Power plowing.—The investigations of previous years have been quite conclusive to the effect that traction plowing, with the ordinary types of heavy traction engines, is not practicable in most parts of the Philippine Islands. No further work was done along these lines except the operation, for a short while, of a petroleum engine previously purchased. This Bureau was unable to obtain a cable plowing outfit on account of lack of necessary funds, but it is highly desirable to give this system of plowing a thorough test as soon as the necessary machinery can be purchased.

During the year there has been considerable interest shown in the subject of light farm motors, a class of machinery which received the special attention of the Director of Agriculture during his visit to Europe and the United States the previous year. So far, only one make of this class of machinery has been offered for sale in the Philippines and only a limited opportunity was offered for giving it a test. It is a gasoline motor truck with a 28-horsepower four-cylinder engine with auto-starter and, in general construction, is the same as an ordinary motor truck and has a gross weight of about 2,500 kilos. The engine shaft extends out in front of the engine far enough for the attachment of a belt pulley for use when the machine is required for driving small farm machinery, such as corn mills, threshing machines, and irrigation pumps. The rear wheels have extension rims and automatic folding mudhooks. This motor was tested for plowing, harrowing, and for running a centrifugal pump and, in general, gave very satisfactory results. For field work it was operated at first without load but it soon developed that it did not have sufficient adhesion to avoid slipping of the traction wheels; this was overcome by designing a special rim with diamond mudhooks and loading the truck over the rear wheels.

This class of motor has the advantages of being sufficiently light to pass over almost any type of bridge which is safe for cart transportation; uses a liquid fuel; is easy to transport anywhere; requires no water and can be used as an ordinary automobile truck when not required for farm work. It has the disadvantages of requiring a skilled operator to keep it in good running order; is rather high in original cost and will probably not remain in serviceable condition a great many years like a steam engine.

Other farm machinery.—This division has devoted considerable attention to the selection and installation of several items of machinery on the farms of the Bureau of Agriculture, other than at the forage factory. Among these were the erection of temporary water-works for the stockyards in Pandacan, consisting of a centrifugal pump operated by an electric motor, a riveted steel tank, and necessary pipe lines. This was replaced at the close of the year by the installation of the city water mains in the stockyards.

The pumping machinery used at the Singalong station proved unsatisfactory and was replaced with an air compressor, pressure tank, and the necessary piping for lifting water from the artesian well into the tank at an elevation of about 8 meters. The compressor was operated by an electric motor previously used for driving the pumps. At the Alabang stock farm an engine, line shaft, and two triplex pumps were installed for pumping water to a supply tank and for irrigation purposes. A second artesian well was bored near the one previously in use and the two were connected so as to flow into a large concrete cistern, with which the pumps were connected. A four-inch centrifugal pump with portable engine was installed for pumping water from a stream on the farm for irrigation purposes. An automatic gas plant was installed at the veterinary laboratory at Alabang and a small repair shop was opened at the forage factory for the purpose of keeping in repair all automobiles and motorcycles used by the Bureau of Agriculture.

Expert advice.—During the year many persons, contemplating the purchase of farm machinery or desiring information as to the best types and makes, have consulted the machinery expert of this division and have been furnished, as far as possible, with the information which they desired. Some parts of this work, such as that pertaining to copra driers, hemp machines, and sugar mills, have been handled by other specialists in the Bureau who were specially posted on these different classes of machinery.

Buildings.—A number of buildings have been constructed on the farms of the Bureau during the year, and others have been altered and repaired. This work was mainly at the Alabang stock farm where a number of mixed-material residences and light-material cottages for laborers were erected. Five buildings were constructed on the Carnival grounds for the reception of the live-stock exhibit during the month of February, and at the close of the Carnival were removed and the material used in the construction work at Alabang.

AGRICULTURAL EXTENSION WORK.

Nature of work.—The object of agricultural extension work is to provide a means by which the results of agricultural investigation and experiment may be transmitted to the man on the farm, and thereby made of economic value. The more important lines of agricultural extension work are as follows: Lecture work, inspection work, coöperative demonstration work, agricultural fairs and exhibits, agricultural associations, and distribution of printed matter.

Organization.—An extension work campaign along the lines above mentioned was organized early in the year. The results obtained have been highly satisfactory and indicate the desirability of developing this work as rapidly as may be practicable.

Lecture work.—During July and August, 1910, several extension work lectures, together with lantern slides, charts and other illustrative material, were prepared. From August, 1910, to January, 1911, 6 different employees of the Bureau devoted a part of their time to lecture work. One hundred and sixteen lectures were given in 18 provinces. The enthusiasm with which these lectures were received by the people far exceeded what had been expected. At the close of each lecture the people present were invited to question the speaker, and questions covering all phases of the subjects of the lectures were asked. Requests for lectures were received from many more municipalities than could be visited, and there was every indication that this form of extension work is one that can profitably be used in all of the provinces.

Inspection work.—Probably the most satisfactory means of disseminating agricultural information in these Islands is by the use of well-trained field inspectors, who shall travel through the provinces, visit the farmers on their farms, and not only tell them what to do but also show how improved methods should be carried out. Two agricultural inspectors and one assistant inspector have been detailed on work of this nature in the Visayan Islands during a part of the year.

Coöperative demonstration work.—The object of coöperative demonstration work is to provide practical object lessons in improved methods of farming and to secure active participation in such demonstrations by the farmers themselves. This work is closely related to that of field inspector, and our field inspectors have undertaken during the year to interest the people in this work. Many of the more prominent farmers in different prov-

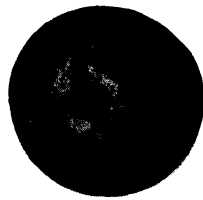
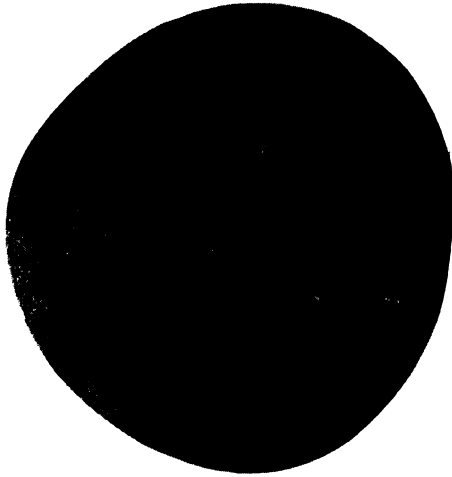


PLATE VI.—TYPES OF COCONUTS.

inces have expressed a willingness and desire to assist in coöperative demonstration work at such time as the Bureau shall have the men to furnish the supervision required.

Fairs and exhibits.—The holding of agricultural fairs and shows is a popular, and in many ways a valuable means of agricultural educational work. In the Philippine Islands this work is covered by the annual Carnival held in Manila, and the expositions held at the different provincial capitals. The Bureau of Agriculture has taken an active part in these fairs during the past year, both in the preparation of exhibits and in furnishing lectures on agricultural subjects. Large exhibits of both live stock and plant products were made at the last Carnival. Exhibits and lectures were also sent to the fairs held at Zamboanga and Bacolod, and a lecturer was detailed to the fair held at Lingayen. A very creditable exhibit of the agricultural products of the Philippines was prepared and forwarded to the Annual Agri-Horticultural Show held at Singapore. During the latter part of the year covered by this report a very complete exhibit of the fibers and fiber products of the Islands was prepared and taken in person by the fiber expert of the Bureau to the Fiber Congress held at Surabaya, Java.

Agricultural associations.—The necessary arrangements were made by this Bureau for holding the annual conference of the Insular Agricultural Association in Manila during the week of the Carnival. This conference was held in the Marble Hall of the Ayuntamiento, and covered a period of four days. A number of prominent speakers were present, including Prof. C. V. Piper, agrostologist of the United States Department of Agriculture. Considerable interest is now being shown in agricultural association work, and several provinces have organized local associations during the year.

PUBLICATIONS.

THE PHILIPPINE AGRICULTURAL REVIEW.—In the preparation of the REVIEW, the aim has been during the past year to cover more thoroughly than in former years the field of Philippine agriculture, eliminating in a large measure the reprinting of material already published in other tropical magazines. As a result of this policy, the REVIEW has been made up almost entirely of original material, prepared principally by employees of this Bureau. Another prominent feature has been the increased space given to the publication of matter pertaining to veterinary and animal husbandry work. Constant attention has been given

to the correction and revision of the mailing list. The REVIEW now occupies a well-recognized place among the agricultural publications of the world. The local demand for it has become much greater than can be supplied, and it is only a question of time when it will become necessary to place this publication on a subscription basis.

Other publications.—Three bulletins have been published in English and three in Spanish during the year. Bulletin No. 7, "The Garden," which was proven to be one of the most popular bulletins of the Bureau, has been revised and now includes the subjects of cacao, coffee, bananas, and oranges. Farmers' Bulletin No. 12, "Abacá (Manila hemp)," has been revised. Farmers' Bulletin Nos. 16 and 17, "The Cultivation of Tobacco in the Philippine Islands," and "Coconut Culture," are new bulletins. The tobacco bulletin has been published in the Ilocano and Ibanag dialects, as well as in English and Spanish. Fifty thousand circulars, containing elementary information regarding rinderpest, have been published in English, Spanish, Tagalog, Visayan and Ilocano. Small editions of 9 different reprints from the REVIEW have been printed. The following is a complete list of the publications of the Bureau for the year:

	English.	Spanish.	Local dialects.
The Philippine Agricultural Review.....	38,150	44,600	-----
Bulletins:			
Bulletin No. 7, "The Garden".....	2,500	2,000	-----
Farmers' Bulletin No. 12 (revised edition), "Abacá (Manila hemp)".....		2,000	-----
Farmers' Bulletin No. 16, "The Cultivation of Tobacco in the Philippines".....	2,000	3,000	-----
Ilocano.....			2,000
Ibanag.....			2,000
Farmers' Bulletin No. 17, "Coconut Culture".....	2,500		-----
Circulars:			
Rinderpest Circular No. 1—			
English and Spanish.....		20,000	-----
English and Tagalog.....			10,000
English and Visayan.....			10,000
English and Ilocano.....			10,000
Reprints:			
Pleuro-pneumonia in Cattle.....	100		-----
Agricultural Extension Work Lecture, No. 1, "The Cultivation of Corn in the Philippine Islands".....	200	200	-----
Agricultural Extension Work Lecture, No. 2, "The Vegetable Garden".....	200	200	-----
Agricultural Extension Work Lecture, No. 3, "Abacá (Manila hemp)".....	200	300	-----
Fertilizers.....	200	200	-----
The Agricultural Association and its Value to the Philippine Farmer.....	100	200	-----
Constitution and by-laws of the Insular Agricultural Association of the Philippine Islands.....	200	300	-----
Statistics regarding Hemp and Rice in the Philippine Islands.....	100		-----
Statistics regarding Sugar Cane and Tobacco in the Philippine Islands.....	100		-----
Total	46,550	73,000	84,000

CROP REPORTING AND STATISTICS.

The collection and compilation of crop and live-stock statistics for the Islands, by means of the quarterly crop reports, comprises the major part of the work of the statistical division. There is a constantly growing demand from year to year for detailed information regarding crop areas and yields in the Philippines, and such information must necessarily be based on carefully compiled statistics. There is also a demand for current information concerning crop conditions. These data are obtained by means of monthly reports received from employees of this Bureau, senior inspectors of the Bureau of Constabulary, and provincial governors. The collection of live stock statistics is especially provided for by Executive Order No. 24, dated March 31, 1911, which provides that municipal presidents shall prepare an accurate statement of the domestic animals in their respective municipalities, giving the name and address of the owner and the number of animals of each class, the location where they are kept and the name and address of the caretaker when he is other than the owner. It further provides that such lists shall be revised subsequently every six months, on the first of January and July of each year.

Act 1898, making it the duty of all municipal presidents to furnish the Bureau of Agriculture with quarterly crop and live-stock statistics, has now been in operation two years. During the year just ended there has been a marked improvement both in the degree of correctness of the reports received and in the promptness with which they have been sent in. The total number of quarterly reports received for the fiscal year just closed was 3,103 as compared with 2,636 for the previous fiscal year.

For the purpose of disseminating information regarding the crop-reporting work the statistician has attended a number of assemblies of municipal presidents held at the provincial capitals and a traveling inspector has been kept in the field during the greater part of the year. At the assemblies above referred to the local officials have been shown the direct advantages to the people of keeping this Bureau informed as to actual existing conditions regarding crops and farm animals and have been furnished with detailed information regarding the method of preparing the crop reports. The traveling inspector has visited every municipality in the provinces to which he has been detailed and has furnished local officials with still further information regarding the crop-reporting work.

Early in the year it was deemed best to discontinue the monthly municipal crop reports as it was hoped that by concentrating all of their energies upon the quarterly reports the presidents would give to them more time and attention, resulting in greater accuracy and completeness. These monthly crop reports have been replaced by a Monthly Summary of Crop Conditions furnished by each provincial governor under the provisions of Executive Order No. 13. These monthly reports will be compiled and furnished the daily press of Manila and the Bureau of Insular Affairs.

Blank forms have been prepared to be used in the preparation of the live-stock reports provided for by Executive Order No. 24. These forms will be distributed so as to be used for the July, 1911, report. The comprehensive live-stock statistics that will be obtained under the provisions of this Executive Order will be of particular value in connection with the work of controlling and eradicating animal diseases.

SPECIAL INVESTIGATIONS.

The local production of an abundant supply of satisfactory forage for both native and imported live stock is a line of work of great economic importance in these Islands, and one that has been given special prominence during the year covered by this report. The investigations with various forage plants carried on by the Bureau at its different stations and farms, and the work of the forage factory have already been discussed in detail. In addition to this regular work, there have been, also, two special forage investigations with which the Bureau has been directly connected; one by Prof. C. V. Piper, agronomist of the United States Department of Agriculture, the other by a forage board appointed by the Secretary of War. The reports of these two investigations are to be published in the August, 1911, number of the PHILIPPINE AGRICULTURAL REVIEW.

Investigations by Prof. C. V. Piper.—The object of Professor Piper's investigations was to ascertain, by personal observation, the existing conditions in these Islands with respect to the local production of forage with a view to the improvement of the situation. Professor Piper arrived in Manila on February 12, 1911, and his work in the Islands covered a period of nearly five months. During this time he visited many of the provinces, carried on tests with forage plants at the stations and farms of the Bureau, introduced a number of new forage plants, and outlined work to be carried on during the coming year.

The forage board.—On September 1, 1910, the Secretary of

War appointed a board of officers of the Civil Government of the Philippine Islands and of the United States Army to investigate and report upon the present cost of forage for use of the Army in the Philippine Islands. This board was directed, after careful and exhaustive consideration, to report whether native forage can be substituted for that now used, and if so, to what extent; the advisability of using, in part, native grasses grown in the vicinity of the various posts, with a view to reducing transportation; the relative cost of the two, and what methods, if any, should be adopted for procuring native forage; and, if deemed necessary, to conduct experiments for the purpose of ascertaining the utility and cost of production of native forage. The board was also directed to consider the question of using, wholly or in part, *native beef* for the Army in the Philippine Islands. The Director of Agriculture was a member of this Board, and several employees of the Bureau have devoted considerable time to matters pertaining to its investigations.

The first meeting of the board was held on September 5, 1910, and its investigations were continued through the remainder of the fiscal year. These investigations were conducted with thoroughness and great detail, and a large amount of valuable data was obtained, which will no doubt prove of great value and economy in the maintenance of Government live stock.

Very respectfully,

G. E. NESOM,
Director of Agriculture.

The Honorable,
the SECRETARY OF PUBLIC INSTRUCTION,
Manila.

PRINCIPAL PHILIPPINE IMPORTS AND EXPORTS— OCTOBER.

By the INSULAR COLLECTOR OF CUSTOMS.

[Values in dollars United States currency.]

IMPORTS.

		Manila.	Cebu.	Iloilo.	Total.
Rice	{Kilos	8,183,080	7,289,876	2,720,853	18,194,529
	{Value	410,866	345,713	124,075	880,654
Beef cattle	{Numbers	1,007		651	1,658
	{Value	23,934		26,275	50,209
Sugar	{Kilos	338,306	47,762	43,059	429,127
	{Value	25,974	3,859	3,589	33,422
Coffee	{Kilos	35,633	246	204	36,083
	{Value	11,618	74	115	11,807
Cacao	{Kilos	37,624			37,624
	{Value	13,605			13,605
Eggs	{Dozens	345,393	177	158	345,728
	{Value	25,497	20	18	25,535
Raw cotton	{Kilos				
	{Value				

EXPORTS.

Hemp	{Kilos	6,790,121	1,732,759		8,522,880
	{Value	755,340	183,020		938,360
Sugar	{Kilos	2,447,521		225,996	2,673,517
	{Value	176,993		9,125	186,118
Copra	{Kilos	10,344,545	2,932,945	100,447	13,377,937
	{Value	1,014,033	299,000	9,624	1,322,657
Cigars	{Numbers	14,828,666			14,828,666
	{Value	229,640			229,640
Cigarettes	{Numbers	2,887,150			2,887,150
	{Value	2,351			2,351
Tobacco	{Kilos	1,202,760			1,202,760
	{Value	162,895			162,895

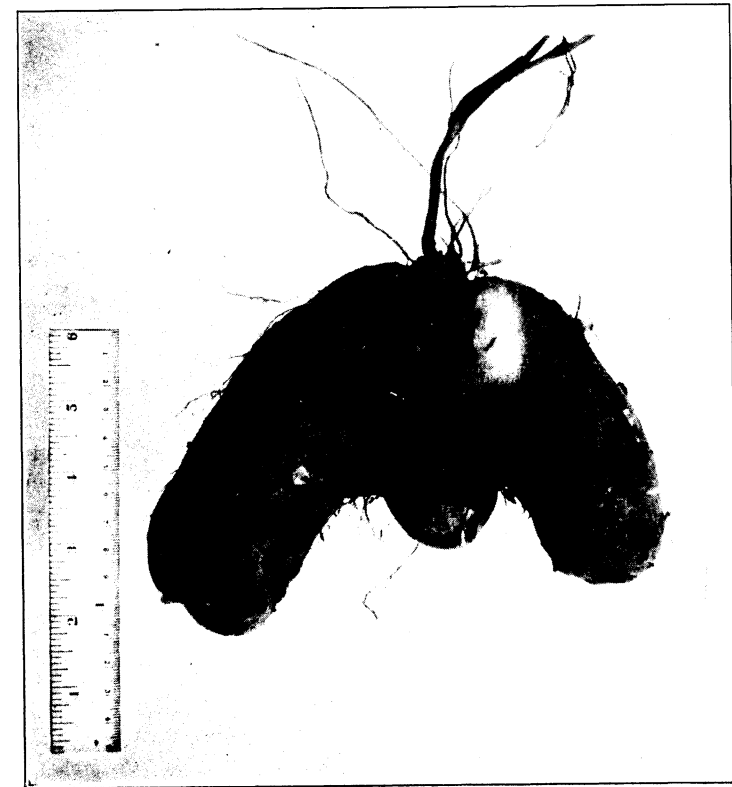
TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES—OCTOBER.

By the DIRECTOR OF THE WEATHER BUREAU.

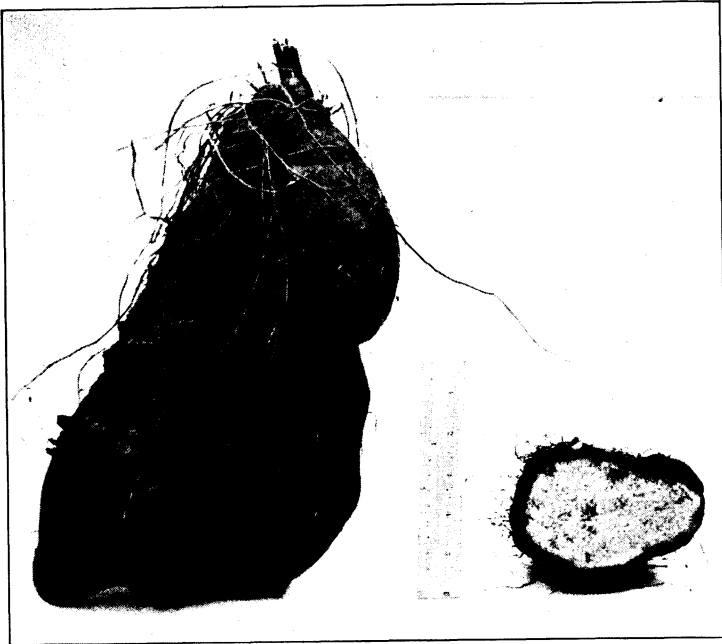
OCTOBER, 1911.

[Temperature and total rainfall for twenty-four hours beginning at 6 a. m. each day.]

Date.	Hemp.				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.		Temper- ature.	Rain- fall.	Temper- ature.	Rain- fall.	Aparri.		San Fernando.	
	Temper- ature.	Rain- fall.	Temper- ature.	Rain- fall.					Temper- ature.	Rain- fall.	Temper- ature.	Rain- fall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	27		27.2		26.9		27.8		25.5		25.3	
2	27.6		27.1	1.5	27.3		26.8		26.9		27	
3	28.4		27.3		27.4		28		26.8			
4	28		27.7		26.4	3.9	28.2		26.8			
5	27.3		26.8	11.4	26.8		28.3		25.8	15.8		
6	27		27.3	2.3	26.6		28.4		24.8	50.6		
7	27.9		27.6		27	.8	27.6		25.7			
8	27.8		27.6	.8	26.8	4.3	28		26.2			
9	27.4	.5	27.7		27.6	1.8	28.2		26.4	5.1		
10	28.2		26.2	12.5	26.9	1.6	28.2		26.2	6.1		
11	28.8	15	26.1	15.7	27.5		28.6	9.6	25.6	7.1		
12	27.2	14.7	27.4		26.6	.8	28.5	7.4	26.3			
13	27.4	23.6	26.8		26.2	26.4	28.6		26.5	1.1		
14	27.5		27.2	2	26.1		28.6		26.2	3.3	27.6	
15	27		27.8		27.4		28		25.7	21.3	27.7	.5
16	28.5		26.7	2.5	27.1		27.5		24.8	136.3	27.8	
17	28		27.2	27.9	27	.3	28.1	3.6	24	21.6	27	
18	27.4	36.3	24.4	47.3	25.4	8.1	26.9		24.1	2	26.8	.5
19	27.7		25.4	10.9	25.7	39.9	27.3		24.9	.5	26.6	
20	27.9		26.6	10.7	26.5	3.3	27.3		24.3	9.2	27.5	
21	27.5		27		26.2		27.3		25.6		26.9	
22	27.4		26.4		26.2		26.3		24.1		26.1	
23	27.4		27.4	8.1	26.2		25.6		24.7		27.2	
24	26.2		26.8		25.9		27.4		25		27.5	
25	27.7		27.1	1.3	26.3		27.4		24.9		28.4	
26	27.8		25.8	3.1	26.3		27.4		25.8		27.4	
27	27.5		26.6	1	26.5		27.3		25.8		27.2	
28	26.7		27		26.2		27		25.4		28.4	
29	28.5		26	6.9	27	1.3	27.2		26		27.9	
30	28.6		26.7	5.3	27.4		27.2		25.4		27.6	
31	28.2	4.3	26.6	13.2	27.2		27.8		26.4		26.9	



a



b

PLATE I.—(a) AN ALL-WHITE YAM FROM BOHOL. (b) THE RED WHITE YAM.

THE PHILIPPINE *Agricultural Review*

VOL. V

FEBRUARY, 1912

No. 2

CONTENTS AND ILLUSTRATIONS.

CONTENTS.

	Page.
Editorial	59
Circular No. 12. Plant Pest Remedies	62
Yams, by O. W. Barrett	67
Tests of Antirinderpest Serum, by Archibald R. Ward and F. W. Wood.....	75
The Embryony of the Mango, by P. J. Wester	80
Some Swine Feeds for the Philippine Islands, by C. W. Edwards.....	83
Agricultural Conditions and Prospects in Palawan Province, by O. B. Burrell.....	89
Current Notes—February	95
Book Reviews, by O. W. Barrett	103
Monthly Crop Conditions—November	105
Market Reports—November	110
Crop Reports for the Quarter ending June 30, 1911	113
Range of Prices of Philippine Agricultural Products for the Quarter ending June 30, 1911	117
Principal Philippine Imports and Exports—November	118
Temperature and Rainfall for Agricultural Districts in the Philippines—November	119

ILLUSTRATIONS.

PLATE I. (a) All-White Yam from Bohol. (b) Red White Yam.....	Frontispiece. Facing page—
II. (a) Common Tugue, from Batangas. (b) Yam of the Limalima Type	74
III. Mango Seedling, Illustrating Polyembryony	82
	Page.
IV. Map of Palawan Province	91

EDITORIAL.

A FEDERAL VETERINARIAN FOR THE PHILIPPINES.

The needs of the work of cattle quarantine and meat inspection have emphasized the necessity of having in the Bureau of Agriculture, for a time at least, a man thoroughly familiar with the practice of the United States Department of Agriculture in these matters. Through the courtesy of the Secretary of Agriculture, and of the Chief of the Bureau of Animal Industry, at Washington, permission has been granted to Dr. George S. Baker, inspector of the port of San Francisco, and inspector in charge of the meat inspection station at San Francisco, to spend

a year's leave of absence in the employ of the Bureau of Agriculture in the Philippines, with the intention of returning to his former employment at the expiration of that time. Dr. Baker is too valuable a man to the Bureau of Animal Industry to warrant his permanent separation from that Bureau, but it is confidently believed that during his year in the Philippines he may organize the meat inspection and quarantine service of the veterinary division of this Bureau, and place the work in such a condition that it may be permanently carried on with the efficiency of that of the United States Department of Agriculture.

Dr. Baker is a veteran in the service of the Bureau of Animal Industry, having been employed in the Bureau from the first year of the organization of the meat inspection work, was appointed to the Chicago station in 1891, and transferred to San Francisco in 1895, where he has been continuously until coming here.

During his term in San Francisco, he organized the meat inspection service, a quarantine service for the Port of San Francisco, handled the exportation and interstate movement of live stock, and coöperated with the State in the eradication of glanders and tuberculosis. His work of supervising the exportation of horses and cattle to Hawaii made him practically the guardian of the live-stock interests of that territory, in that he was able to prevent the exportation of diseased animals from San Francisco. About 6,000 head of horses, mules, and cattle, are shipped to Hawaii annually, and during Dr. Baker's recent visit to Honolulu the board of commissioners of agriculture and forestry tendered him a congratulatory letter pointing out that during his term as inspector of the port of San Francisco not a single diseased animal had been received from California.

The meat inspection work involves the ante-mortem and post-mortem inspection of about 3,500 animals, and the manufacture of about 100,000 pounds of meat food products daily. Besides the matter of meat inspection and cattle exportation, Dr. Baker's judgment will be of great utility to the Bureau in other matters pertaining to the interisland movement of animals and the shipment of live stock by rail.

Dr. Baker is one of the leaders in the movement for clean milk in California, is a member of the San Francisco County Medical Society Milk Commission, and is prominently identified with the State Association of Medical Milk Commissions.

He is also a member of the National Association of Medical Milk Commissions, and has contributed freely to the literature

of the relation of milk to the public health, and to the relations of bovine tuberculosis to the public health. He is also a member of the California Public Health League, and of the State Commission on Tuberculosis.

Before entering the veterinary profession, Dr. Baker secured an arts degree from McGill University in Montreal, Canada, returning a few years later to his alma mater for his veterinary degree.

CIRCULAR NO. 12.

DEPARTMENT OF PUBLIC INSTRUCTION,
BUREAU OF AGRICULTURE,
Manila, P. I., December 1, 1911.

PLANT PEST REMEDIES.

By P. J. WESTER, *Horticulturist.*

Plants are sometimes attacked by insects or by parasitic vegetable organisms that destroy part or all of the plant attacked. Fortunately the insects are in many instances preyed upon in their turn by insect parasites or parasitic fungi which increase rapidly when climatic and other conditions are favorable for their development; thus many pests that but for these parasites would always be a serious danger to many agricultural crops are kept in check by natural agencies. This is particularly true of many insect pests in the Philippines.

However, it may sometimes be found necessary to combat an insect pest or a disease by the application of a fungicide or insecticide, according to its respective use. These mixtures are commonly called "sprays."

A fungicide is a mixture employed in the control of a disease caused by a fungus. The dead or dying branches or twigs in a shrub or tree infested with a fungus disease should be pruned out before spraying to render the latter more effective. It should be remembered that a fungus that has entered into the bark and wood cannot be destroyed by a spray. The mission of the fungicide is to prevent reinfestation of the plant by the fungus by the coating of the plant with a material that on contact destroys the fungus.

The term insecticide denotes a spray that is used in the warfare against insects.

Insect pests that can be controlled by spraying are divided into:

(a) *Biting insects*, such as caterpillars or larvæ of various butterflies, moths, or beetles, locusts etc., in fact any insect that *eats* the leaves or twigs of plants; these pests may be destroyed directly by spraying the plants with a solution containing a poison, usually arsenic.

(b) *Sucking insects*, which attach themselves to the leaves, twigs or trunks of plants or trees and weaken or destroy parts of the plant or when they are present in large numbers, even kill it. Among such insects are the mango hoppers that in some seasons destroy the mango-bloom; the various scale insects that infest the mango, citrus and many other fruit trees; the mealy bugs; several species of very small insects, hardly visible to the naked eye, called mites, that sometimes discolor some of the citrus fruits by puncturing them and sucking out the juice; and the aphids, or as they are commonly called, "green flies." The sucking insects are controlled by "contact sprays," so named because they kill the insects by contact, i. e., by closing up their breathing pores.

(c) *The fruit flies*, which lay their eggs on young or nearly mature fruits of certain species of plants, the larvæ after hatching entering the flesh of the fruit and destroying it. These are controlled by poisonous bait sprayed on the trees they infest.

In order to be effective, the spraying should be thorough and the application liberal. The pressure should be sufficient to cause the spray to settle on the plants as a fine mist and not in large drops. *It is advisable in using sprays whose effect on a certain plant is not well known, to spray a few plants and wait a few days to see if any ill effects appear before spraying the whole orchard or field.*

For the small grower the "knapsack" or compressed air sprayer that can be carried on the back by a man is large enough, but the planter who operates on a larger scale will find a barrel sprayer—with 15 to 20 meters of 13-millimeter rubber hose attached, mounted on wheels—the most convenient. The "Ver-morel" nozzle is preferable to other types of nozzles. If a knapsack or compressed-air sprayer is not obtainable, an ordinary bucket pump to which a hose with spray nozzle is attached, can be used.

It is important that the spraying mixture be well strained so as to prevent the nozzle from becoming clogged in the act of spraying.

A fungicide or contact spray may also be rendered effective against biting insects by adding to them Paris green or arsenate of lead. These poisons should then be added to the spray already mixed as if this were pure water and in the proportions recommended under formulas 4 and 6.

Always remember that the copper sulphate and the arsenates are very poisonous and should not be left where they are accessible to children or domestic animals.

FORMULAS FOR FUNGICIDES AND INSECTICIDES.

1. BORDEAUX MIXTURE.

For fungi.

Copper sulphate	kilograms....	1.5
Unslaked lime	do.....	1
Water	liters....	100

Place the copper sulphate in a feed sack and suspend it in a barrel containing 50 liters of water so that the sack is just covered by the water. Slake the lime in another vessel by adding a little water at a time, and when slaked, dilute to 50 liters. Before mixing stir the two solutions thoroughly. Then dip a bucket from each solution and pour the two liquids together in the spray barrel, at the same time agitating the mixture vigorously. An excess of copper sulphate is injurious to the foliage, and before spraying the mixture should therefore be tested. This is done by inserting and holding in the mixture a clean steel blade for one or two minutes. If copper is deposited on the blade, more lime must be added. Use the mixture at once.

2. KEROSENE EMULSION.

For scale and other sucking insects.

Kerosene	liters....	7.5
Hard soap	kilogram....	0.25
Water	liters....	4

Dissolve the soap in boiling water and while still very hot add the kerosene. Churn the hot liquid steadily for fifteen or twenty minutes by using a force pump, the liquid being sprayed back into the vessel until it is emulsified. Sufficient hot water should be added to increase the solution to 16 liters. For spraying dilute at the rate of from 1 to 3 liters of the emulsion to 15 liters of water.

3. SELF-BOILED LIME-SULPHUR WASH.

For fungi and scale.

Quicklime	kilograms....	3
Sulphur (flour of sulphur)	do.....	3
Water	liters....	100

Place the lime in a barrel and pour on enough water to cover it. When the lime begins to slake, add the sulphur after running it through a sieve to break the lumps. Stir the mixture constantly and add water as needed to form a thick paste at first, and then gradually a thin paste. The lime will supply enough heat to boil the mixture several minutes. As soon as the lime

is well slaked add water to cool the mixture and prevent further cooking. Strain carefully, working the sulphur through the strainer, and dilute to 100 liters. *This spray is at the same time effective against fungi and scale.*

4. PARIS GREEN.

For biting insects.

Paris green	grams....	60 to 120
Quicklime	kilogram....	0.5 to 1
Water	liters....	100

Place the lime in a wooden vessel and slake, dilute to 100 liters, and add Paris green. London purple may be substituted for Paris green and used at the same rate. Both these poisons, particularly the Paris green, have a tendency to settle and the liquid should be kept in constant agitation during the spraying, else the spray from the bottom of the barrel may seriously damage the foliage while the rest is useless.

5. PARIS GREEN.

For biting insects.

Paris green	grams....	25
Air-slaked lime	kilogram....	1

Mix the two ingredients thoroughly and place the mixture in a bag of cotton cloth and shake it over the plants until they are covered with a thin layer of dust. This formula is especially recommended for vegetables. The mixture should be applied to the plants in the morning while the plants are still wet with dew. If the lime is not obtainable flour or fine road dust may be used as substitutes.

6. ARSENATE OF LEAD.

For biting insects.

Arsenate of lead	kilogram....	0.5 to 1
Quicklime	do.....	0.5 to 1
Water	liters....	100

Slake the lime in a wooden vessel, dilute to 100 liters and dissolve the arsenate of lead in the liquid. Like the Paris green the arsenate of lead settles to the bottom of the vessel and the mixture should therefore be kept constantly agitated during the spraying.

Among the sprays for biting insects, formula 6 is taking the lead in preference to Paris green and is one of the most effective and economic sprays of the present day.

7. THE MALLY FRUIT FLY REMEDY.

Arsenate of lead	kilogram....	0.6
Sugar	kilograms....	7.5
Water	liters....	100

Dissolve the arsenate of lead in a small quantity of water, dilute to 100 liters and add the sugar.

This formula is recommended to the mango growers in the Philippines as a remedy for the mango fruit fly. The spray should be applied to the foliage and never so heavily that it drops to the ground from the trees. The application of this spray should be supplemented by the gathering and burning of all immature fruits that fall from the tree, or they may be disposed of by burying them not less than 30 centimeters deep, or by feeding them to hogs.

8. TOBACCO DUST.

For aphids.

Cucumbers, watermelons, eggplants, etc., are frequently attacked by small, green or black sucking insects, commonly called "green flies" or "plant lice". These insects, while they may also be destroyed by contact sprays, are best kept in control by the use of tobacco dust. Apply the tobacco dust liberally to the plants wherever these insects appear.

O. W. BARRETT,

Chief, Division of Experiment Stations.

Approved:

F. W. TAYLOR,

Director of Agriculture.

YAMS.

By O. W. BARRETT,

Chief, Division of Experiment Stations.

It would be fairly easy to name the five most important food plants of the world but the second five would be a much more difficult matter to decide upon. The true place of the yams in the world's list of economic plants is a debatable matter, but for the sake of argument we may regard them as holding about fifth place. It must be remembered in this connection that outside of Europe and North America nearly all the inhabitants of the earth's surface are either in China or in the Tropics, and while China makes use of but one or two varieties of yams, both the Old and the New World Tropics depend to a very large extent upon this root-crop as a food supply throughout the greater part of the year.

On account of the habit of the plant itself, the methods of culture, storage, and sale, yams are not prominently in evidence and consequently many travelers, and even residents in countries like India or the West Indies, do not appreciate, and in many cases it seems, do not even know the important rôle of this crop. For instance, in Porto Rico, where yams rank as the second most important root-crop, they are seldom used by the American families unless the family in question has resided there for several years; in fact, it is a common case for the housewife to purchase third-class and almost inedible potatoes at from 30 to 40 centavos a kilo, when close by the side of the potatoes there are heaps of excellent yams, offered at about 10 centavos a kilo. Probably the rough, coarse appearance of yams accounts, in part, for this lack of popular favor which is so evident among European and American residents in the Tropics.

It is certain, however, that the yam is one of the very oldest cultivated root-crops, having been grown in India for many centuries; it was also an important crop of the aborigines of Tropical America when the early Spanish navigators entered that region. In fact, it would seem that yams vie with the sweet

potato, the taro, and the yautia for antiquity in point of cultivation by man,—all these food plants having been under domestication so long that they seldom or never produce seeds. Some species of yams do, however, on very rare occasions produce flower clusters and a few of the domesticated species undoubtedly produce viable seeds under favorable conditions. The yams have broken the regulations, so to speak, for plant reproduction in two ways: A number of varieties commonly produce small, or in the case of the air-potato, large tubers in the axils of the leaves (a rather rare infraction of the law); furthermore they all (?) possess the trait of sending sprouts from almost any part of the surface of the tuber-like root, which, however, is not very uncommon in the plant world.

Botanically the yam family is rather closely related to the smilax and the lily families, yet for certain reasons it stands alone in a class by itself. There are supposed to be only about 160 species in the family, which consists of some eight or nine distinct genera, but practically the entire family depends upon the genus *Dioscorea* which comprises about 150 botanical species. Of these 150, only some ten or twelve species are important in the world's food supply list and probably three-fourths of the cultivated varieties are included under not more than five or six species; however the actual number of distinct *varieties* and named sorts comprised under these few species is unknown. For some reason both the economic and the taxonomic botanists have neglected this most interesting group of plants; specimen sheets showing only leaves are not desired by the herbarium student and it appears that no collection which could in any way boast of being fairly complete has ever been made, either in the Western or Eastern Hemisphere. The writer once grew a collection of about 25 kinds, nearly all of which were of West Indian origin. It is probable that the Pacific archipelago and the East Indies, Philippines, India, and tropical America each possess a considerable number of endemic varieties and it is quite possible there are 100 distinct forms of the true yams in cultivation at the present day.

Most yams have peculiar leaves, with 3, 5, or 7 midribs instead of one as in most other plants. The leaves are frequently leathery and shining; insect pests seem unable to injure them.

While nearly all the yams are twining or climbing plants, a few, like the "Mapues" varieties of the West Indies, can be grown without artificial supports of any kind. Some varieties attain a height in six months of 20, or even 30 meters. A few varieties like the "Yampee" (*Dioscorea trifida*) are almost un-

branched; that is, the root send up two or three stems which grow principally at the tip without producing many side branches; others, like the "Water" yams (*D. alata*) throw out a vast number of side branches, a single plant being able to cover a surprisingly large area with its luxuriant but weak foliage. Some varieties have strong woody stem which may attain a diameter of 3 or 4 centimeters, while others produce only slender herbaceous stems. Many varieties are armed with strong prickles, and, in a few cases, even the roots bear such defensive spines that the harvester must remember to never put his hands into the hill in digging out the roots.

The flower clusters, when produced, are usually a raceme, or spike. The seed from these, in some varieties at least, is winged to enable it to be carried by the wind. The roots, sometimes called tubers, but always incorrectly, have no "eyes" whatever. While filled with a starchy substance like the potato and cassava, they are usually covered with a more or less thick rough bark; a few of the Philippine varieties are clothed only by a thin integument resembling that of the ordinary potato. In most varieties the root is irregularly cylindrical but may be of almost any shape; in fact, the shape of the root and the color of its integuments (for there is a true, usually colored skin beneath the coarse outer bark) serve to distinguish the closely related varieties which may be apparently identical as to foliage and habits of growth. In India a few kinds (the *D. globosa*) are nearly spherical. Some kinds produce a dozen or more finger-like roots, more or less attached at their bases to the foot of each stem. Some, like the Chinese yam, which is said to be native to the Philippines, have very long and slender roots; this feature renders their cultivation extremely difficult, although their quality may be excellent. One of the wild yams of Porto Rico has roots scarcely ever more than 3 centimeters in diameter, but of indefinite length; the quality is so fine, however, that the natives frequently forsake their fields of sweet potatoes, yautias, and even ordinary yams, to dig for this wild inhabitant of the jungle.

The weight of the edible roots of the yam plant of course varies with the variety, the cultivation given it, and the season, soil, etc. While one-half kilo may be considered a fair yield for the very high-priced "Mapues," and 2 kilos a heavy yield for the delicious "Yampee," some of the "Water" yams may give 10, or even 25 kilos. The world's record for a yam root was probably attained in the State of Florida, United States of America, a few years ago when one plant gave some 60 kilos

of edible root, though this was probably the result of two seasons' growth. Ordinarily six or eight months suffice to mature roots of the principal cultivated varieties; a few can reach maturity in five months, while some wild forms require at least twelve, and probably in many cases, twenty or more months to reach their maximum size.

In planting yam roots only the basal, or upper portion, is customarily used; under favorable conditions even the tip of the yam root can be made to throw sprouts, but it is usually a waste of materials to plant the distal half of any ordinary yam. Sections or chunks of the cylindrical rooted varieties weighing from 40 to 100 grams are regularly used in planting; if the whole tuber is planted, especially if it weigh more than one kilo, decay may set in from some external injury, and before the sprouts could develop sufficiently to resist the attack, all of the material might be consumed.

In its habits of sprouting the ordinary yam closely resembles the sweet potato, which also is not a tuber, but a root. The sprouts, which from their uncommon origin are called adventitious, may arise from any point on the surface of the root, though the tendency is confined largely to the basal half. In this connection it may be remarked that the cassava, which also stores up starch in a true root, cannot be induced to send out sprouts from even the basal end of the root.

Unlike most other root crops, growing yams have a pronounced faculty of being able to resist drought and the roots after harvesting may be kept for months in a very dry atmosphere without injuring their viability in the least; in fact, in some countries the roots, or the portions of them to be used for planting, are hung up in the shade, sometimes in the roof of the dwelling house, and at the proper time for planting the roots begin to send out reddish or purplish shoots, thus advising the planter of the fact that they consider it time to begin another season's work, so to speak. The drought-resisting habit of tender-leaved plants like the "Water" yams is rather difficult to understand, since it appears that there is no special physiological or anatomical arrangement in the leaf surface or stem of the plant to prevent evaporation of sap. The writer has noticed in East Africa yam plants in thriving condition with no indication whatever of wilting during a prolonged drought when all other crops and most of the native plants were practically dried up. This is still more strange because the yam plant has no taproot and only a very moderate number of feeding roots; moreover, these latter do not seem to penetrate deeply,

as might be expected, into the water-bearing strata of the soil.

Among the numerous characteristics of the yams which render this crop of plants worthy of special study and put them in a sort of class by themselves in plant societies, is the probably constant feature of possessing in the raw state a poisonous substance known as dioscorein; this little-known vegetable alkaloid has powerful effects upon animals or man even when eaten in small quantities. Were it not for this fact the wild yams would probably soon be exterminated on account of the eagerness with which the roots would be sought after by wild pigs and other forest animals; it is said that even poultry instinctively recognize the dangerous nature of raw yam roots and refuse to touch them until cooked. Some yams possess a peculiar, rather sickening odor, while others have only a starchy smell like that of a potato. All yams appear to have, in addition to the starch, a gummy or mucilaginous substance which is probably of a harmless nature. On account of this gummy material, yams can never be used as starch producers for the reason that the gum prevents the settling of the starch grains when the root is ground and mixed with water; neither salt nor acids appear to be able to "cut" this gum and therefore a mixture of ground yam and water will ferment before settling. Upon cooking, however, all traces of the alkaloid disappear and the gum itself is broken up so that at least in the case of the principal yams—even some of the "Water" type—they become "mealy" like the very best potatoes. Perhaps the whitest of all root crops when cooked is the common "Tugue," a variety of yam which has recently come to our notice and which appears to be confined to certain districts in Luzon; its white fecula is brilliant and without the creamy tinge that most potatoes have. A few yams, even when baked, still remain somewhat watery, or at least pasty. The size of the starch granule does not appear to vary greatly in the different kinds of yams; it is of moderate size and somewhat resembles the cassava granule.

The color of the fecula, or starchy matter of the root, varies from snow white to a dull purplish black; many varieties are simply tinged with reddish or purple, but probably 75 per cent of the total number are creamy white inside with an inner bark of some other shade, such as pink, purple, yellow, etc. There is a wide range of aroma in the cooked roots; one of the common Philippine yams when baked has a pronounced odor like that of fresh raspberries. In 1907 this variety was introduced into the United States by Mr. William S. Lyon and the writer.

Much has been written about the "air-potato" but this yam

deserves very little attention by the practical agriculturist. Its axillary tubers, sometimes weighing up to 500 grams, are so bitter that unless specially treated by lime juice and by soaking in water before cooking they are hardly edible. This species (*D. bulbifera*) is an exception to the rule that all yams produce edible rootstocks. The potato-like tubers, which are borne in the axils of the leaves, are of an almost indescribable shape,—roughly three-angled, convex on one side, and sometimes with the angles more or less notched or toothed. Some species of yams, like the Hawaiian, may reproduce themselves by small axillary tuberous roots, while under certain conditions the “Water” yam group may have a small number of axillary tubers, or adventitious tuber-like roots, of very variable sizes and shapes, but always covered with a coarse strong bark like that of the true rootstock. These above-ground tubers and tuberous roots may be used for propagation and are especially useful in shipping by mail, since they will ordinarily endure four to eight months without moisture. It is a question whether these small resting buds would produce as great yields as would the ordinary rootstocks or sections thereof.

On account of the tendency on the part of the larger growing types of yams to bury the main roots to a depth of 50 or even 80 centimeters below the soil surface, it is customary to plant the cuttings, or “root heads” on top of a mound of earth; this is possible because of the utter disregard of the young yam plant for moisture. While every other plant, except perhaps the cacti, would be dried out before the feeding roots could get down into the moist soil, this high-hilling style of planting does no harm to the yams. A system recommended for planting the Porto Rico yams, and which is believed to be the best for large plants or plantations, is the following: A deep trench is made by plowing, either with a middle-breaker plow or by running an ordinary plow in opposite directions in one furrow and then removing the loose earth in the furrow by means of a spade; this furrow now being 25 to 40 centimeters deep is filled in with layers of grass, weeds, leaves, etc., and earth alternately, each layer being from 10 to 15 centimeters thick. When this operation is completed, all the loose earth on each side of the trench being brought up, there will be formed a ridge over the trench; at the time of setting the “heads” this ridge will have settled somewhat and it should then be elevated by taking up the earth on each side until some 8 to 12 centimeters of earth are left on top of the heads which should be some 20 to 30 centimeters above the normal soil surface.

The heads may be set from 30 to 60 centimeters apart in the case of the smaller growing varieties, and 50 to 100 centimeters apart in the case of the larger sorts. The trenches, or rather ridges, should be from 60 to 120 centimeters apart, depending upon the variety, soil, etc. The trench must always be drained since yams are intolerant of any stagnant water. In case of a sloping surface the trenches should run parallel with the slope, so that no rain water may collect between the ridges. This system greatly facilitates digging the deep-rooting sorts and apparently enables the yam root to strike downward without the tremendous opposition exerted against it by the firm soil, which would be the objectionable feature under the ordinary method of planting. Furthermore, the decaying of the vegetable matter furnishes plant food to the roots, holds moisture for the deep roots, and, probably more important still, permits perfect ventilation around the rootstock and feeding roots.

Most varieties require poling; that is, the long weak mass of vines must be kept up off the soil on supports, trellises, or something of the sort. This system of supports not only offers a larger surface to the light, but prevents fungus diseases from attacking the leaves and stems. In this connection it may be said that yams are singularly free from either insect or fungus attacks, though certain rots, probably bacterial in nature, attack the rootstock through wounds in the surface.

In localities where winds are strong the poles or trellises must, of course, be well braced to prevent blowing over, since the heavy growth of vine on the pole acts like a sail and takes the full force of the wind.

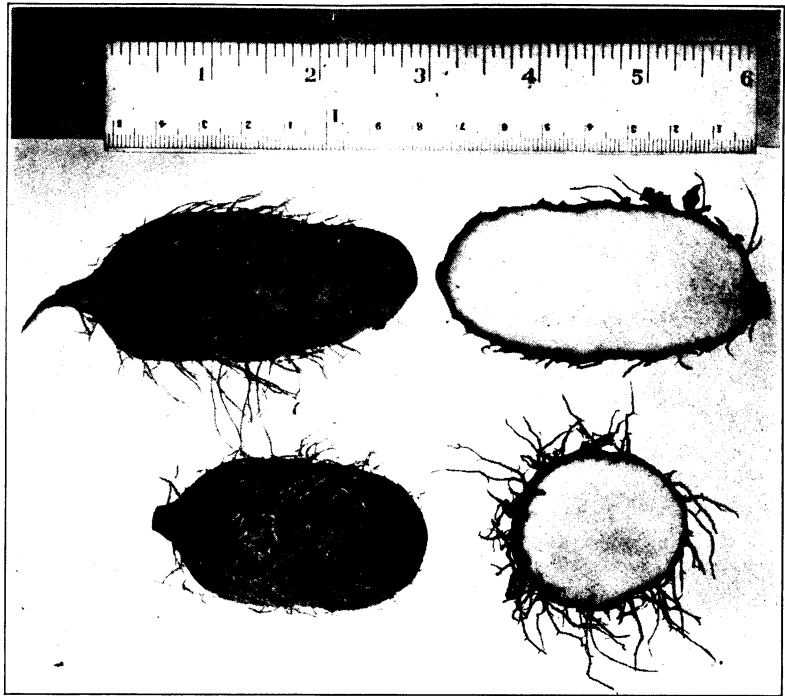
Yams may be cooked in the same way as potatoes, or sweet potatoes. Some varieties are preferable baked, while others seem better boiled. A favorite dish in some countries is made by boiling roots until nearly "done", then slicing and frying in coconut or olive oil. Yam cakes, made by mashing the boiled or baked roots, then adding milk, or cream, butter, eggs, and cheese, and then frying, are excellent. Puddings can, of course, be made, as is done with sweet potatoes. Yam flour, made by grinding the dried slices of either raw or partially cooked roots, can be made into a variety of dishes; unfortunately there is a trace of tannin in most yam roots and this usually discolors the slices if in contact with any metal; in fact, it would appear that there is a peculiar substance in the white yams which turns the whole fecula surface brownish within a few hours after exposure to the atmosphere. Flour made from the black, purple, and red varieties is, of course, somewhat objectionable to ortho-

dox housekeepers, but it is interesting in its uniqueness and the flavor is surprisingly good, especially if during the drying process the slices have neither been scorched nor tainted with metallic compounds.

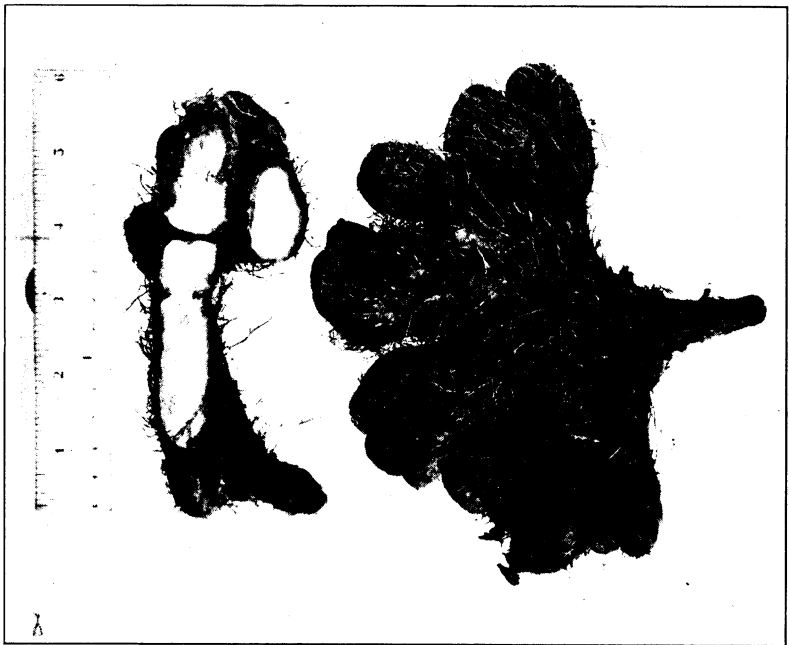
Unfortunately the word yam is commonly applied to several varieties of sweet potatoes in the Southern United States, and although authorities differ widely as to which varieties of the sweet potatoes this erroneous term applies, the word has become so popular in some districts of the south and southeastern United States that it will take many years to eradicate the mistake. About the only resemblance or relationship between yams and sweet potatoes is based upon the fact that both happen to be root crops and grow from "vines."

In the Philippines there is a deplorable lack of appreciation for the yams as a crop, and though a few varieties are cultivated in certain districts, it will probably be a long time before the markets will offer to the public a constant supply of first-class roots. There are probably several sorts native to the Philippines which are not found elsewhere, one of which, the small white Tugue of Luzon, bids fair to become a very high-priced, if not famous edible article. Several of the better Tropical American sorts are being introduced and gradually the public will come to demand something besides imported potatoes and second-class native sweet potatoes in the line of Philippine root-crops.

There is undoubtedly a good field here for the earnest planter in the study of yam problems,—not alone for his own table but also as a commercial enterprise.



a



b

PLATE II.—(a) COMMON TUGUE FROM BATANGAS. (b) YAM OF THE LIMALIMA TYPE.

TESTS OF ANTIRINDERPEST SERUM.

By

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Chief Veterinarian,

AND

FREDERICK WILLAN WOOD, D. V. M.,
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The introduction of antirinderpest serum has exerted a profound influence on methods of combating rinderpest. It has been employed extensively in the more civilized countries where the disease exists to-day. The literature shows widely differing statements concerning the precise method of using serum in combating rinderpest, and its usefulness. This fact and the results of its use in the Philippines seemed to warrant further investigation of the effect attained by the use of serum, particularly by the use of serum alone.

Serum has been used in combating rinderpest in various parts of the world with different objects in view. In India it is injected into animals which are immediately exposed to the disease by contact with infected animals which results in their contracting the disease and passing through an attack, the severity of which has been modified by the serum. In other places serum has been used with the idea that it would absolutely protect the animal from attack during a certain period, generally stated by writers on the subject to be from two to four months in duration.

In addition to the use of serum alone for the purpose of accomplishing benefit in the two ways mentioned before, injections of serum have been employed simultaneously with injections of the blood of a sick animal which is capable of transmitting the disease. The result of this simultaneous inoculation, as it is termed, is an attack of rinderpest in the injected animal, varying in severity according to the amount of serum used and the care given the infected animal, and resulting in a permanent immunity.

Serum has been extensively used in parts of Africa and in

the Philippines with the expectation of conferring to the animals injected with the serum an absolute immunity against attack.

Here in the Philippines, besides injecting serum, effort was made to discover and isolate infected animals so that the spread of the disease might be prevented. The results of the use of serum in the field were not such as to confirm the belief that animals injected with serum were protected against attack for any period whatsoever. Sickness and even death have occurred with disturbing frequency within two weeks after injection. In the early days the dose employed was 50 cubic centimeters per 100 kilos, which dose was frequently doubled in the effort to obtain the results desired.

The whole theory of preventing attack of rinderpest by the use of serum seemed to us to rest upon a very insecure foundation of evidence by experiments, and in view of the results obtained in the field, it seemed highly desirable to conduct in the Philippines a series of tests designed to throw light upon the value of serum in combating rinderpest.

An extensive series of tests have been conducted, the results of which will appear elsewhere in complete detail. Various considerations limit the present article to a bare enumeration of the kind of tests conducted and the conclusions drawn therefrom.

Experiment No. 1.—Fifteen Batanese cattle were injected with doses of 20, 35, and 50 cubic centimeters per 100 kilos body-weight and were immediately thereafter exposed to the disease along with the others to serve for the purpose of comparison with the animals which received the various doses of serum. The animals injected with serum came down with the disease within a very few days from the time of the appearance of the disease in the animals which received no serum. The results were very striking, since the conditions of the experiment were such that absolute protection from attack might have been expected to exist for several months.

Experiment No. 2.—The experiment was conducted with twenty carabaos and was planned to duplicate Experiment No. 1 in every respect, but exposure was accidentally deferred for about a week, a matter of no consequence to the experiment. The animals, whether injected or not, all displayed symptoms of the disease at or about the same time, which demonstrated that serum had not postponed attack.

Experiment No. 3.—Serum prepared from immune cattle and that from susceptible animals both failed to defer appearance of symptoms in cattle more than a few days. The character of the disease was much milder in animals receiving serum from animals originally susceptible.

Experiment No. 4.—Serum from cattle injected into cattle in doses of 50, 75, and 100 cubic centimeters per 100 kilos every five days did not defer attack to any significant extent although the character of the course of the disease was modified.

Experiment No. 5.—Infection of exposed animals was not prevented by doses of from 10 to 100 cubic centimeters injected at various intervals of from one to seven days. Appearance of symptoms was delayed but slightly. The character of the disease was profoundly modified, especially in the matter of temperature.

Experiment No. 6.—Simultaneous inoculation was performed, using 190 cubic centimeters for animals varying in weight from 222 to 290 kilos, with a loss of 15 per cent.

Experiment No. 7.—Simultaneous inoculation was performed on a group of animals weighing from 232 to 300 kilos, using 290 cubic centimeters of serum each, with no loss.

The results are most striking when compared with those of the previous experiment in showing the effect of variation in dose of serum upon the severity of the disease. The larger dose in this experiment eliminated all symptoms but temperature in all cases, and in seven animals temperature did not exceed 39° C.

Experiment No. 8.—Comparison of serum from the *Institut Pasteur de Nha-Trang*, Indo-China, with ours showed no striking difference in character.

Experiment No. 9.—A similar comparison of our serum with that prepared at the experiment station for animal diseases, Tokyo, Japan, showed that our serum is similar in character to that prepared in Japan.

Experiment No. 10.—In general the experiment showed that the longer the delay between injection and exposure to infection, the more severe the attack. The inference is that antirinderpest serum is rapidly eliminated from the system. Holmes in India has shown this better by a nicer graduation of dosage.

Experiment No. 11.—Injection of serum alone in doses of 80, 100, and 200 cubic centimeters in the absence of exposure to rinderpest infection caused an immediate rise of 1° in temperature.

GENERAL CONCLUSIONS.

The foregoing experiments seem to show that antirinderpest serum does not prevent infection with rinderpest. On the contrary, animals injected with serum and exposed to rinderpest soon contract the disease and pass through a more or less modified attack. We have shown that the blood of animals is infective during this attack.

BEARINGS OF RESULTS UPON METHODS OF COMBATING RINDERPEST.

Our conclusions indicate the inadvisability of relying upon serum to prevent attack as advocated by writers using this method in various parts of Africa.

Formerly in the Philippines serum was undoubtedly used with the idea that it would absolutely protect against attack, although quarantine and sanitation were enforced to some degree.

When the use of serum alone is combined with sanitary measures with the object of eradicating the disease, the amount of success is dependent upon the efficiency of the sanitary factor. Such a practice involves the combination of methods that are inconsistent. If serum protects against infection, no quarantine is needed to protect the injected animals. If serum does not protect against attack, the spread of the disease is not checked by serum and on the other hand quarantine will accomplish the desired result. Another objection to such a combination consists of the fact that when injected animals are protected from infection by quarantine or similar measures, they miss the opportunity of passing through an immunizing attack during the period that the serum is still effective. On the contrary if injected animals do contract rinderpest the cases are not easily recognizable and such animals spread infection, where, if serum had not been used, the cases would have been recognized.

Under such conditions the use of serum is superfluous, expensive, and, by disguising cases, increases the difficulties of a campaign of sanitation. If in spite of these objections it is considered advisable to use serum, it must be recognized that injections of all susceptible animals must be repeated at frequent intervals, involving a prohibitive expense.

If serum possesses a curative value its use might be justified, but our results do not warrant such a belief.

The use of serum alone with measures to induce infection is undoubtedly useful as a palliative measure as practiced on the plains of India among highly resistant cattle. There the character of the population, nature of the country, and the magnitude of the task utterly prevent maintaining an effective quarantine. The susceptibility of the cattle and of most of the carabao in the Philippines is such as not to warrant attempting to use this method, especially as efficient quarantine may be maintained.

Our results have led us to the conclusion that simultaneous inoculation under the very best surroundings and care may be successfully practiced upon cattle in the Philippines. Our experience with carabaos as shown in Experiment No. 2 does not

justify us in expecting serum to modify the disease in carabaos so profoundly or as uniformly as in cattle. Some years ago this method was attempted as a field measure in the Philippines but was soon abandoned on account of the serious opposition of stock owners.

We have not been able to ascertain that simultaneous inoculation is anywhere generally practiced in the field except perhaps in Russia. Writers in the Trasvaal, toward the end of the outbreak, apparently did not recommend its employment. Theiler points out the danger from the various blood parasites that may be transmitted by this process.

Arloing, in describing its use in Egypt, states that simultaneous inoculation had to be abandoned in Egypt because a panic took possession of the cattle owners.

In India the application of simultaneous inoculation to a number of susceptible Australian cattle led to disastrous results. A committee of investigation brought out the fact that this method is not generally employed there outside of laboratories. They recommended that as an act of grace the cattle owners be compensated for the loss of their stock.

There are many obstacles and objections to be considered in connection with the employment of simultaneous inoculation as a field measure. Among these are objections of owners to surrendering custody of animals, expense of providing sheds, labor and professional force, cost of indemnity for losses, magnitude of task, and danger of simultaneous inoculation stations as foci of infection. There may be grave danger also of fatal complications from pregnancy, piroplasmosis, trypanosomiasis, foot-and-mouth disease, anthrax, and hemorrhagic septicemia.

Notwithstanding our success with cattle under experimental conditions we do not feel justified in instituting a campaign of simultaneous inoculation as a field measure in combating rinderpest in the Philippines.

It is not our intention to discuss the methods and results of quarantine and sanitation, other than to note that these measures are now being relied upon exclusively in the Philippines.

THE EMBRYONY OF THE MANGO.

By P. J. WESTER, *Horticulturist.*

The seeds of most plants are always monoembryonic, *i. e.*, each seed produces only one plant, though in some plants like the orange (*Citrus aurantium* L.), the tangerine (*Citrus nobilis* Lour.) and the yambo (*Eugenia jambos* L.) the seeds are also frequently polyembryonic; in these species one seed may contain several embryos, each of which, under favorable conditions, is capable of producing a plant. The mango (*Mangifera indica* L.) is both mono- and polyembryonic, the seeds of the latter type frequently producing six to eight plants, and as many as thirty have been observed to spring from one seed. (Plate III.)

In the study of polyembryony of the citrus, it was found:

That the embryos, other than those developed from the fecundated egg-cell, are derived from certain cells of the nucellus, lying near the embryosac wall, which become specialized, grow and develop rapidly and form a tissue mass which pushes out into the embryo and produces an embryo similar to that formed in the normal way from the egg-cell. The embryos formed in this way were called by Strasburger, the investigator, "adventive." If we correctly understand the action of fecundation, it is clear that in this group only those that develop from the egg-cell proper as a result of the fecundation would show indications of hybridization; since the adventive embryos develop from the mother tissue, in these we should not expect to see any of the characters of the male parent.¹

The validity of this theory by Webber and Swingle was fully proved and strikingly demonstrated before the fruiting of the seedlings in the course of their work in hybridizing the orange and *Citrus trifoliata* L., the leaf characters of the parents being so distinct (the orange being unifoliate and the other parent trifoliate) that the respective characteristics were easily recognized in the hybrids. In some instances where several seedlings developed from one seed, one was found to be a true hybrid and the remaining plants false hybrids, or exhibiting the characters of the mother plant only.

As far as the writer is aware the polyembryony of the mango

¹ Webber, H. J. and Swingle, W. T., Yearbook U. S. D. A., 1904, p. 22.

seed was earliest discussed at some length by Reinwardt nearly a century ago.¹

In fact, Gaertner had already noted the peculiar structure of the mango seed, but he was probably not aware of its significance. Reinwardt's paper was accompanied by a colored plate illustrating the polyembryonic character of the seed and he also mentions the occurrence of monoembryony among the cultivated varieties. Later references to the polyembryony of the mango have been made by Schacht,² Strasburger,³ and Cook,⁴ but the monoembryonic character of the seed of this species seems to have been lost sight of, or at least, no importance attached to this feature.

In Florida the observation has been made that the seedling types, all being polyembryonic, transmit their characters to their progeny in a remarkable degree, *i. e.*, "come true to seed." Of course, variation exists but the main characters of a type are well reproduced. This feature of "reproduction of type" of the inferior seedling varieties has also been noted in Jamaica; this is contrary to the habit of the imported grafted varieties from India, whose progeny is variable.⁵

The types grown in the Philippines, popularly but incorrectly called varieties, are well known to reproduce themselves true to seed, and, as the writer has had the opportunity to ascertain in the examination of fruits from a large number of trees, there is, in the botanical characters of the tree, the form of the fruit, the color and texture of the skin, the color, texture, flavor, aroma, and presence of fiber in the flesh and the shape of the seed in the individual trees of the different types, a uniformity of general characteristics that is truly striking. The absence of mangos exhibiting the combined characters of two types, as far as noted by the writer, is very remarkable. Were the characters above referred to the only features to be considered in a fruit tree there would be ample justification for setting out seedling mango orchards of the two best of these types, the Carabao and the Pico. On the other hand, all seeds of the grafted mango varieties introduced into Florida from India, except Cambodiana, that have come to the attention of the writer, have proved to be monoembryonic; of the Mulgoba seedlings that have fruited there, none have retained the characters

¹ Acad. caes. leop. carol. nova acta, 1825, Vol. XII: pp. 343-346.

² Madeira and Tenerife, 1859, p. 53.

³ Jenaische Zeitsch. d. Naturwiss, 1878, Vol. XII: pp. 652-657.

⁴ Torrey, 1907, Vol. VII: No. 6, pp. 115-116.

⁵ Bul. Bot. Dept. Jamaica, 1901, Vol. XIII, p. 165.

of the mother parent to the degree that the seedling polyembryonic types do. The statement made by C. Maries from India, that "If the seed from the best and finest sorts are planted, the chances are that fifty per cent will be as good as the fruit planted, a few better, and the rest worse,"¹ would seem to indicate that perhaps most if not all the East Indian grafted mangos are monoembryonic. It is significant that the only variety introduced into Florida from the East that is said to reproduce itself from seed, the Cambodiana, from Saigon, is polyembryonic.

A most interesting account of an investigation on the formation of the embryo in the mango is found in the report of the Florida agricultural experiment station for 1908, pages 109 to 125, accompanied by several illustrations. Belling, the investigator, in an examination of fruits from two trees of a seedling type (polyembryonic) in Florida, discovered no formation of embryos from the egg-cells in the ovaries and all the embryos seen were adventive. He also notes the coincidence of monoembryony in the grafted varieties seen by him, but seems to think that this is the result of grafting for several generations rather than an inherent botanical character in these varieties.

Though well aware of the desirability of having more material for study than has been available before reaching a definite conclusion on the subject, the writer, from the data collected, ventures nevertheless to advance the theory that the species *Mangifera indica* L. may be divided into two great types: One, the monoembryonic, to which belong most, if not all, of the mango varieties in India; the other, the polyembryonic type, the mangos belonging to which transmit their characters to their progeny. To the latter type belong the mangos of the Philippine Archipelago, the Manila of Mexico, the seedling types that are cultivated in Florida, and perhaps those in most other parts of the Tropics. The Cambodiana also belongs to this group; in fact there are so many similarities between the Cambodiana, the Mexican Manila, and the Carabao type of mangos grown in the Philippines that it is not difficult to believe that the one has sprung from the other, or else that they are of common parentage.

The writer is indebted to Mr. D. G. Fairchild, Bureau of Plant Industry, United States Department of Agriculture, for the photograph accompanying the paper.

¹ Watt, G., Dictionary of Economic Products of India, 1891, Vol. V: p. 148.



PLATE III.—MANGO SEEDLING, ILLUSTRATING POLYEMBRYONY.
(From negative owned by the United States Department of Agriculture.)

SOME SWINE FEEDS FOR THE PHILIPPINES.

By C. W. EDWARDS, *Agricultural Inspector.*

Swine raising is an industry found very generally throughout the Philippine Islands, for, unlike many other branches of agriculture, it does not necessitate a large outlay of capital and quick returns are realized. It is within the means of every Filipino farmer to produce and market each year a few hogs. The question then arises, are the present methods of production, under existing conditions, conducive to the largest returns, and, if not, in what way may they be improved upon?

Under the present system of management, aside from that employed by a few of the more up-to-date growers, the hogs are allowed to run at will and forage a greater part of their subsistence, practically the only feeds fed being tiqui tiqui and sliced banana stalks. While this method does not involve much expense the gains are slow and small and there is no doubt but that it is within the means of every farmer to improve upon it in such a manner as to increase his yearly profits very materially. The two principal lines of improvement are the up-grading of the native stock by selection and crossing, and the growing and feeding of more and better feeds. The former is a longer process than the latter and is not within the immediate means of every grower. However, regarding the latter, there are a number of forage, grain and root crops, one or more of which is within the reach of every farmer, that are known to be adapted to the country and can be marketed profitably in the form of pork.

The present commonly used feeds, tiqui tiqui and banana stalks, are of a very low nutritive value, being mostly cellulose. They are too bulky when fed alone, though the former can be combined to advantage with some of the more concentrated feeds.

Corn properly ranks first among the grains adapted to swine production, and is grown in every province of the Islands. It is utilized in the United States as a swine feed more extensively than any other grain, being often fed as an entire ration. Better results, however, are obtained when it is fed in conjunction with other feeds which contain more protein. In some

cases in this country where the yield per hectare is very low a more economical crop could perhaps be grown, but if proper attention were given to seed selection, preparation of soil, planting, and cultivation, corn growing could soon be placed on a profitable basis with respect to swine breeding, bearing in mind the value of the fodder produced which may be fed to other farm animals.

In this article it is not the intention to go into detail as to the methods of cultivation, etc., of these crops, and these points will only be touched upon in a general manner. At harvest time seed should be selected for the next year's crop; good-sized, well-shaped ears should be taken from the largest stalks, hung in a protected place, and allowed to dry. Near planting time a few kernels should be shelled from each ear and their power of germination determined. From those showing the highest percentage of germination should be selected the seed for planting. Too close planting is a common error. Proper distance depends upon the soil, season, and variety. In rich soil having ample rainfall planting in hills (two kernels to the hill) 30 centimeters apart in rows $1\frac{1}{2}$ meters apart has been advocated, but on ordinary soil this is too close and 1 meter each way in hills of three kernels is a safer distance. Cultivation should be deep at first and more shallow and frequent as the crop nears maturity. Many experiments have been made to determine the most advantageous method of feeding the corn crop. Many farmers of the so-called corn belt of the United States practice the plan of "hogging off," as opposed to yard feeding. By "hogging off" is meant the turning of hogs into a field of standing corn and allowing them to pull down the stalks and consume the corn at will. The arguments in favor of this method advanced by many growers are, first, the saving of time and labor in harvesting; second, pork may be produced with less grain than by feeding ear corn; third, the cost of fencing is less per hectare than the cost of husking; and fourth, there is no more waste of the corn than when fed in the yards.

In this country such a procedure would perhaps prove satisfactory only in localities where labor is scarce and bamboo for fencing material is plentiful. Under such conditions fields could be divided into lots by portable or permanent fences. The lots should not be too large, as the hogs should not be turned into more corn than they can dispose of within three weeks during the dry season, or two weeks during the rainy period. No doubt the best results for the average farmer will be realized by using the corn in conjunction with other feeds.

Kafir corn has been grown extensively in a number of the provinces. On fairly good soil a large amount of grain (seed) and forage are produced. These seeds compare favorably in feeding value with corn; however, the crop is considered secondary to the common maize.

Most growers realize that to attain the best results ample pasturage should be available. Nevertheless in this country the question of fencing must be considered, and under certain conditions the practice of utilizing pastures for swine producing may be impracticable; certain forage crops, however, can be disposed of so advantageously by this method that in many instances this plan might be followed very profitably. Among the most important crops of this class are peanuts and chufas. Peanuts are now grown to some extent in the majority of the provinces but very seldom are they considered as swine feed, the nuts being used as a human food and the tops as forage for horses and cattle. In many tropical countries this tuber is considered a very valuable hog feed. It may be utilized as a pasture or as a grain crop, the fruits being harvested and fed with other feeds, and the tops dried and stacked to be used later as hay. The nuts are high in protein content making them a valuable component when used in a mixed ration with tiqui tiqui and corn. The most profitable method, however, is to utilize the plant for pasture purposes, since in this way the animals consume the green forage so necessary to growth, together with the grain, and the labor of harvesting is eliminated. The value of a hectare of peanuts when fed with corn and converted into 8-centavo pork is valued in the southern United States at ₱40.16. The common native peanuts now grown are very inferior to the improved Spanish varieties, which have given excellent results as forage crops in the Tropics. The seeds should be planted on ridges or in furrows—according to the season—from 60 to 90 centimeters apart, depending upon the variety, kind of soil, etc. Frequent cultivation should be practiced until the spreading of the vines renders this impossible. If the field is not over-pastured the tubers left in the ground germinate, producing a continuous crop.

The chufa is a sedge having edible tuberous roots. They grow splendidly in all parts of the Islands and the crop is considered to be about equal in value to peanuts. The tuberous roots are planted in rows much the same as peanuts. Many experiments have been performed by the United States Department of Agriculture tending to show that it is more profitable to feed some grain to pigs pasturing on chufas and peanuts

than to require them to make their entire growth upon these alone.

Among the forage plants which can be grown to advantage in this country are sorghums, Japanese sugar cane, soybeans, velvet beans, and cowpeas. Orange-sweet and amber sorghums have been tested by the Bureau and found particularly adapted to this country, a seeding producing three cuttings. The value of a hectare of sorghum as pasturage, when corn is also fed, is estimated at from ₱20 to ₱40. Considering the ease with which a heavy crop of this forage can be grown and the fact that three crops are obtained from each sowing, this forage should find favor with Philippine live-stock producers.

Japanese sugar cane succeeds very well as a forage crop in the southern United States, Japan, China, and South Africa, and although it has not been grown to any great extent in the Islands without doubt it would do very well here. As a hog feed, however, it is inferior to the common bean and tuber forages. Like the sorghums the common practice is to sow in drills 75 to 90 centimeters apart, using about 13.5 kilos of seed per hectare.

Soybeans are raised extensively in the Tropics and although the various experiments with American varieties have not proven them particularly adapted to this country, no doubt some of the Indian, Japanese, or Chinese varieties would be more adaptable. The importance of this crop is such that it warrants thorough experimentation. It is very valuable both as a pasture and a grain-producing plant, and its value does not lie in its food products alone, but in the fact that it, like other legumes, has the power of adding nitrogen to the soil, thus making it of especial value in restoring land of low fertility; in addition, the roots leave the soil in a good mechanical condition. In this country where fertilization is so little employed there is a crying need of a more common use of leguminous crops. In many parts of the Tropics the soybean can be grown with greater ease than corn, being more resistant to drought or excessive moisture. The same general methods of culture may be applied as have been recommended for corn. If a crop of beans is desired it is best to plant in drills 60 to 90 centimeters apart, using from 30 to 50 kilos of seed per hectare. If a pasture is desired the seed may be sown broadcast, using about 65 kilos per hectare. In the latter case very little after-cultivation is necessary since the plants soon shade the ground and kill the weeds. The yield in forage and grain will vary widely, depending upon the conditions under which the crop is grown. From 20,000 to 28,000 kilos of green forage per hectare is only a fairly

good yield and the average soil will produce from 1,500 to 2,700 kilos of seed per hectare. The fodder ranks high in feeding value, comparing favorably with peanut tops. The beans are about two-fifths protein and one-sixth fat, or nearly $3\frac{1}{2}$ times as much protein and about three times as much fat as corn. The bean meal has a very high percentage of digestibility. In using the crop as a pasture the expense of harvesting is dispensed with and the droppings from the animals are of great value in enriching the land. There are very few fruit or grain crops, however, that are so rich and can be used to such good advantage in the compounding of rations as the soybean. The only other vegetable product comparing with it is the peanut, so that in many cases it may be found more profitable to harvest the crop and use the bean meal in a mixture with other crops.

Sufficient experimenting with the velvet bean has been done to demonstrate that it can be grown successfully as a swine forage. The meal is very nutritious, comparing well with the soybean, and a wonderful amount of green forage is produced. It is perhaps best grown with a supporting crop, such as corn, sorghum, or sugar cane. The Lyon bean is cultivated in several of the provinces. It is a very heavy producer, but is subject to rust and has a very coarse stem and leaves.

Cowpeas, another leguminous forage crop, have been grown successfully at the Lamao experiment station in Bataan. The iron varieties, which are particularly disease resistant, seem to be the ones most valuable for the Philippines. The value of this plant as a grain or forage crop is inferior to the velvet bean, soybean, or peanut. The bean meals may be utilized as a component of a ration containing bulky feeds, such as tiqui tiqui, etc.

The above-mentioned feeds may be combined in various ways, some of which are suggested as follows:

No. 1.—Two-thirds Kafir corn meal; one-third bean meal.

No. 2.—Two-thirds corn meal; one-third bean meal.

No. 3.—Three parts tiqui tiqui; 2 parts corn meal; 1 part bean meal.

Peanuts may be substituted for the bean meals.

Root crops are especially valuable to the small farm inasmuch as a large quantity can be produced on a small area. They occupy a definite place in the list of swine feeds, but, owing to their high water content and bulkiness, they should not constitute the entire ration, but should be used along with components high in protein. Some of the most important root crops for this country are yautias, taros, sweet potatoes, and cassavas.

The yautia is a West Indian plant and is met with very generally throughout the Tropics. It has been grown successfully on the Bureau stations and in places near Manila. It is a heavy yielder, certain varieties often producing on moderately fertile soil 28,000 kilos of edible tubers per hectare, besides 4,500 kilos of rootstocks. The taro, or common gabi, is well known to the Filipino, being found throughout the Islands. These crops require about six months to mature. The young plants are generally set in rows about 90 centimeters apart, the distance depending upon the variety. Sections of the rootstock, as well as the tubers themselves, are used in planting.

The better varieties of native sweet potatoes, or camotes, have a feeding value about equal to the gabi, but as pasture plants they are inferior to any of the legumes mentioned.

The cassava is said to be a native of the Philippines, and although not eaten as readily by swine as some other root crops, it can perhaps be fed to advantage with a grain ration.

All these roots are often fed in a raw state, but their value is increased considerably by cooking. Any of them may be combined and fed to advantage with bean meals.

As a rule very few swine are raised in the coconut districts, all the pork consumed being purchased from other localities; no doubt a greater part of this pork could be produced by utilizing the coconut milk—which at present on most plantations is entirely waste product—and in cases where oil is produced, copra meal. The “milk” is not rich enough to constitute an entire ration but must be combined with some other component. It adds considerable feeding value to tiqui tiqui, and a few planters are utilizing it in this way; the nuts are broken open on a cement sink-like platform from which drain pipes lead to some sort of receptacle. Copra meal is very rich in protein and consequently serves as a valuable adjunct to combine with bulky components in a mixed ration.

The kinds of crops to be raised and the methods of management of a farm are determined, in a large measure, by local conditions. Each district has a soil, climatic conditions, market facilities, etc., peculiar to itself—and there are many sections that are not capable of producing all the crops dealt with; every district, however, should be able to grow one or more of these crops, and even this one, if grown and used as a swine feed, will add materially to the value of the feeds now used.

AGRICULTURAL CONDITIONS AND PROSPECTS IN PALAWAN PROVINCE.

By O. B. BURRELL, *Agricultural Inspector.*

The data contained in this paper was gathered during a trip covering the period from September 10 to October 13 of the present year for the purpose of inspecting and reporting upon the conditions and agricultural possibilities of Southern Palawan, with special reference to the physical features, soil formation, present vegetation, climate, labor supply, transportation facilities and suitability for agricultural purposes. From Puerto Princesa I was furnished transportation and extended every courtesy by Major James P. Harbeson who was making a visit of inspection to that region on the military launch *General Lawton*.

I landed for inspection and collection of soil samples at Aborlan, Panacan, Separation Point, Brookes Point, and Bonabona on the eastern coast, and at Eran Bay and Alfonso Trece on the western coast of Palawan Island, and on the Islands of Balabac and Pandanan off the southern coast. The information concerning other points was secured from Major Harbeson, Lieutenant Speers and Lieutenant Reid. The areas given are estimates only.

LOCATION.

The Province of Palawan covers an area about 600 miles long by 125 wide, situated in the southwestern quarter of the Philippine Archipelago. Besides Palawan Island it includes the islands lying between Palawan and the Islands of Mindoro, Panay, Negros, Mindanao, the Sulu Archipelago and British North Borneo, chief of which are Busuanga, Coron, Culion, Dumarán, the Cuyo Islands, the Cagayanes Islands, Cagayan Sulu, and Balabac off the southern coast on which is the customs port of the same name.

GENERAL FEATURES.

With the exception of Cuyo and the Cagayanes, these islands contain poor farming land and are very sparsely populated. The southern half of Palawan Island, below Puerto Princesa, and the islands off the southern coast are of the greatest value for agricultural purposes; this region lies south of the typhoon belt with only a short dry season, and has been, up to the present, free from the rhinoceros beetle and other coconut insects, as well as from rinderpest and other diseases of live stock.

Extending from Puerto Princesa to the southern extremity of Palawan is a sloping plain 3 to 5 miles in width between the mountains and the Sulu Sea, mostly covered with a moderate growth of timber. The greater part of the coast line is bordered by outlying coral reefs and a strip of mangrove swamp half a mile in width; for the next half mile inland sandy loam prevails, and the balance is sand or clay loam with clay predominating. Practically no crops are grown except a little palay and vegetables in Tagbanua *cañingins*, with few clumps of coconuts along the coast.

DETAILED DESCRIPTION.

The Iwahig penal reserve extends for 20 miles south of Puerto Princesa to the Saub River, about 6 miles south of Inagaun. From here to Aborlan, 8 miles, the coast is bordered by half a mile of mangrove swamp with good coconut land extending 3 to 4 miles back to the mountains. In this section are found about 1,200 hectares of open meadow land free from cogon, at present used as a cattle range. The soil is a clay loam from 20 to 60 centimeters in depth underlaid with coarse limestone gravel and would make very fair coconut land. Fencing would be necessary for the exclusion of wild hogs, and a road should be built through a mile of swamp and forest to the coast where a good anchorage could be obtained between the coast and Malanao Island half a mile out. A limited supply of laborers could be obtained from the Tagbanua reserve at Aborlan about 3 miles to the south. A telephone line runs across the center of the meadow, open from Puerto Princesa to Brookes Point, but the only available transportation would be by boat, as there are no wagon roads in the entire region with the exception of those within the Penal Reserve.

The Tagbanua reserve covers a region extending about 6 miles along the coast, with Aborlan near the center, and back to the mountain tops.

The large island lying off the coast at this point is covered with mangrove, and is worthless for agricultural purposes.

Below Aborlan to Separation Point lies a low flat plain 3 to 5 miles wide and 30 long; it is mostly dark sandy or clay loam, nearly covered with a moderate growth of timber, and of fair quality for coconuts, hemp or rubber. A few miles below Aborlan is found a large area of open cogon land; extending north

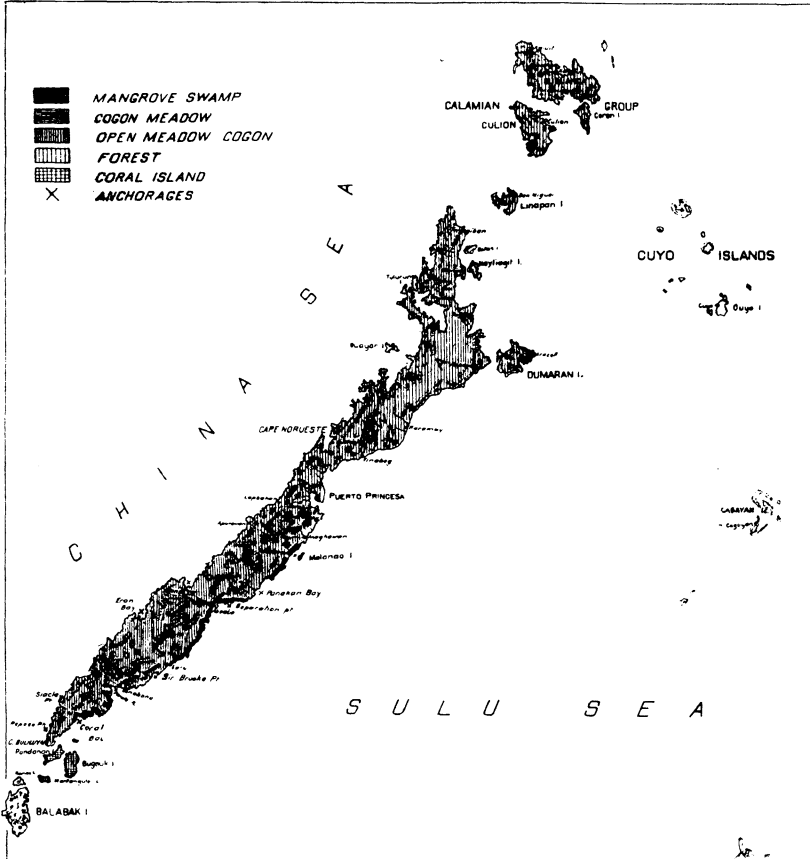


PLATE IV.—MAP OF PALAWAN PROVINCE.

from Separation Point is still another section of about 1,000 hectares of open cogon land dotted with a few small trees and clumps of small-growing bamboo, with half a mile of swamp along the coast. The soil on this meadow is a stiff clay with a little sand in spots.

From here to Brookes Point, 38 miles, the country for a few miles is much broken up by small mountains and ridges with

swampy land along the coast, but as we get farther south the strip of swamp grows narrower with occasional stretches of solid land to the beach, and a level plain extends 3 to 5 miles back to the mountains with a few open cogon patches and old *cañigins*. Half a mile back from Brookes Point is a cogon meadow about 5 miles long and half a mile in width. The soil on the meadow is a stiff clay which would be difficult to cultivate in wet weather. The half-mile strip along the coast is dark sandy loam of good quality for coconuts or rubber.

Beginning four miles south of Brookes Point the Moro Reserve extends 18 miles to Pirate River. From there to the southern end of the island, 30 miles, the plain gradually grows narrower with less swampy land along the coast.

Fair anchorages are found at Aborlan, Panacan, Separation Point, Brookes Point, Bonabona, Coral Bay and at the southern extremity of Palawan Island. On the western coast the character of the soil formation and physical features are much the same as on the eastern, with anchorages at Reposo Point, Siacle Point, Eran Bay and Alfonso Trece.

Of the islands off the southern coast Balabac resembles the mainland in character with level stretches of forest and several good harbors. The low, coral islands, of which Buksac with 6,000 hectares, Pandanan with 4,000, Mantangule with 1,800, and Bancalan with 900 are the chief in size, are of the very best quality for coconuts. They are covered with a slight growth of forest with very little underbrush and no cogon or other noxious weeds. The trees could be cleared off at small expense and nuts planted among the stumps would require little care. On the mainland cogon and underbrush would spring up so thickly as to make it very expensive to care for the trees unless the land were stumped and plowed. The islands also have the advantages of being free from wild hogs and monkeys and also from mosquitos and other insects injurious to the health and comfort of the supervising and laboring force.

CLIMATE.

Moderate rains are fairly evenly distributed over nine months of the year, with more or less extended periods of drought during the months of October, February, and March or April. There are frequently one or more good rains during these months of comparative dry weather and growing crops seldom suffer from lack of moisture. The periods of dry weather are shorter as the southern end of the island is approached and generally speaking nothing is to be feared in this whole region from lack of rains.

Malaria and other fevers are fairly prevalent along the coast of Palawan Island in proximity to the extended areas of swampy land. Upon the coral islands, however, health conditions would be very good.

LABOR SUPPLY.

The native population is composed of primitive Tagbanuas who live in isolated clearings in the forest. In time a fair supply of labor could be developed from among them but at present they will work for only a few days at a time. A larger force could be secured at Cuyo but they do not like to leave their homes for more than a few months at a time, then they go home for a visit and a new lot come to take their places. At present the Culsion leper colony is using about 300 of them on construction work which will be completed about September, 1912. At that time a number would be available for work in Palawan. For a permanent laboring force laborers will have to be brought in from some outside source.

TRANSPORTATION FACILITIES.

At present the *Garcia Pitogo* makes a round trip to Puerto Princesa from Manila every twenty days. The customs launch *Sura* meets the *Garcia Pitogo* upon each trip and proceeds to Balabac and Kudat, British North Borneo, stopping at intermediate points enroute. The military launch *General Lawton* makes a trip every few weeks to Brookes Point and Balabac—where Scout Stations are maintained—and furnishes transportation to those desiring it. The provincial launch *Florence* also makes occasional trips to different parts of the province. Besides these vessels there are a few schooners which transport timber across to Iloilo and take any passengers and freight available. The regular line of North German Lloyd steamers from Europe call at Kudat 90 miles south of Palawan Island, and when there is enough business to warrant it, they can be induced to visit points in Palawan.

AGRICULTURAL POSSIBILITIES.

In the region described there are in the neighborhood of 165,000 hectares of good land available for purchase or lease from the Philippine Government, to wit, about 85,000 hectares on the eastern coast, 60,000 on the western and 20,000 hectares on the islands off the southern coast of Palawan Island. Coconuts would thrive on the entire area, and rubber, hemp and other crops upon the greater part of the land. With the exception of the meadow near Aborlan, the land would have to be cleared and

stumped before planting. If coconuts were planted among the stumps and no plowing was given, the cogon grass would spring up so thickly as to prevent a satisfactory growth.

The ideal location for coconuts is upon one of the coral islands which can be easily cleared off, and no plowing is required. The new shoots from the stumps should be trimmed off for a few months until the roots die, and little further attention will be required until copra making begins.

This region has the great advantage of being free from the coconut beetle and also from live-stock diseases. There is no danger of loss from typhoons or heavy wind storms.

At present there are two large companies who are starting the developing of coconut plantations, the Delawan Bay Company on Balabac Island, and the Malanao Coconut Company on Pandanan Island, and the prospects are good for extensive development in this region of large plantations of coconuts and rubber within the next few years.

CURRENT NOTES ¹—FEBRUARY.

INCREASING INTEREST IN ARTIFICIALLY DRIED COPRA.

At last the idea of making copra has reached the American Tropics. Until very recently, with all the immense production of coconuts in tropical America, no *copra* has been made, the fresh nuts being shipped direct to Boston, New York, Baltimore, New Orleans, and a few other points. The fresh nuts are, to a large extent, made into "desiccated coconut"; that is, the fresh nut is shredded, or grated, into thin strips or shavings; these strips are then compressed by hydraulic power to express the surplus oil, and then the mass is broken up and dried, sometimes with the addition of a little sugar. The demand for coconut oil and the by-products from copra, however, is becoming so great, even in the Eastern States, that attention is now directed toward making copra from the small and broken nuts.

Probably one of the first large copra driers to be erected in the American Tropics is that which is now in operation in Georgetown, British Guiana. This machine is of the heated-air instead of steam type; it requires about twenty hours to dry one charge of the fresh "meat," thus turning out about one ton of the finished product per day. The wholesale price there is about ₨200 to ₨225 per ton, which is rather better than that for the best sun-dried Philippine copra.

At present Jamaica is exporting about 12 million raw nuts and Trinidad about 9 millions, the total value for the coconut products of Tropical America being about ₨4,000,000 per annum. Undoubtedly within the next three years, unless the coconut disease which is now spreading rapidly and doing such terrible damage in Cuba extends throughout Tropical America, the output from the use of artificial driers to save the small and broken nuts will be nearly doubled. The nuts of less than 8 or 9 centimeters in diameter are too small to use conveniently for making the desiccated products; moreover, a considerable percentage of nuts are cracked in handling previous to loading on

¹ Original notes prepared by various members of the Bureau of Agriculture.

shipboard. If some sort of copra drier can be popularized in that region a very large sum will be saved the planters. The Philippine coconut growers need not worry, however, about the price of high-grade copra—that is, unsmoked and bone-dry—going down on that account. In fact, even in the United States factories are now being established for manufacturing butter, cooking compounds, etc., from copra, more or less along the same lines which have succeeded so splendidly in France, Germany, and Holland.

DOMESTIC COCONUT PRODUCTS IN THE UNITED STATES.

At last the United States has begun to advertise *domestic* coconut products; a factory has been established at Portland, Oregon, for handling copra from the Philippines and the Pacific archipelagos. The principal product of this institution is called *Kaola*, which is a vegetable butter resembling suet, especially useful in cooking pastry and for all purposes for which ordinary animal lard can be used. This is not colored with egg yolks as some of the European articles are, but is left in its original white color. Unfortunately the uncolored condition of this butter will practically prohibit its use on the table until people learn that the yellow color of butter is quite unassociated with the question of flavor, digestibility, etc. In this connection it must be remembered that a large part of the butter of commerce is more or less colored artificially by annatto, a substance obtained from the seeds of the Achiote shrub (*Bixa orellana*), which has long been introduced into the Philippines from Tropical America.

This new Kaola butter is said to contain no water; therefore it does not become rancid and does not have any offensive odor in cooking. Its purity and wholesomeness are its strong points.

This new coconut butter costs less than half the price of dairy butter and will, we hope, rapidly find favor with the cooks and housewives of America.

BUD-ROT OF COCONUTS IN CUBA.

The following quotation from the Cuba Review will be of interest to the coconut planters of the Philippines:

Prof. F. G. Earle, one of the commissioners appointed by President Gomez to investigate the disease which is killing coconut trees in Cuba, especially at Baracoa, Oriente Province, has made a preliminary report to the Government.

He states that the exports of coconuts from Baracoa have dropped from 18 millions to 6 millions, that more than half the trees are dead, and that many more are affected. The factory for making oil from unshipped nuts that formerly operated day and night, now operates only two days a week.

The disease has been virulent five years. Affected trees are found on all kinds of soils and at all altitudes. Whole plantations have been completely destroyed, and it is a serious calamity to the district, as coconut groves are the prime source of revenue.

The bud-rot disease of Cuba appears to be identical with the Philippine bud-rot, which still exists in two or three districts here. The latest outbreak reported to this office was in the province of Misamis, Mindanao. Except for the excellent work done by Dr. E. B. Copeland a few years since in checking the spread of this terrible disease, the Philippines might to-day be in the deplorable condition of Cuba.

President Gomez of Cuba has offered a prize of ₱60,000 for the discovery of a cure for this disease.

RICE AND COCONUTS IN SIAM.

The rice crop of Siam is reported to be very short. In the southern part of the country, especially near the larger cities, the coconut industry has deteriorated very seriously in recent years, due to the attacks of coconut beetles. In fact, it is said many of the old plantations have been abandoned on account of this pest, and it is now almost impossible to establish new plantations in the vicinity of the villages which, of course, always furnish breeding places for the grubs of this insect.

A PERENNIAL RICE.

A perennial rice has just been discovered in Senegal, French West Africa. This rice, which occurs wild, or semi-spontaneous in that country, is said to spread by means of rhizomes and may be propagated by this method as well as by seed. The presence of this peculiar root system aids the plant in surviving through even an eight months' dry season. The great importance of such a variety for certain districts in the Philippines can hardly be overestimated. Furthermore, the plant is a first-class forage crop and while probably the yield is not so great as that of some of the Philippine rice varieties, the starch and food contents of the seed are fully as great as in the case of ordinary rice, while the protein is only a very little less.

PHILIPPINE AGRICULTURE AND THAT OF BRITISH WEST AFRICA.

In looking upon Philippine agriculture as it was before the influence of American example and teaching, the most striking feature of the subject, as a whole, has undoubtedly been the wastefulness, or to put it technically, the evident inattention to modern agronomic principles. As a whole, the Filipino farmer

is intelligent enough to know that in many cases he is not getting much more than one-half of the yield from his fields that he could get if he really so desired. In fact, with only some 7 millions of individuals in a country which could easily support 25 millions (and, with proper methods of tropical agriculture, 50 millions) it is, of course, quite unnecessary that the average Filipino farmer should exert himself to grow two or three crops during the calendar year when *one* crop is sufficient for all the needs of himself and family.

As an illustration of what can be done in a thickly populated country, even with severe dry season conditions to combat and difficult means of transportation, we may cite what is being done by the natives of northern Nigeria in British West Africa. In this comparatively small area some 35 millions of people are obliged to consider carefully all wastes and possibilities of losing or winning on the turn of small points in the natural conditions of the country. The British officials, who are now pacifying the country and bringing it up, so far as possible, to a level with the civilization of the Gold Coast, Lagos, and Sierra Leone, can claim but scant credit, if any, for the highly economic methods of the native population of that great grain district of the "coming continent." A correspondent from northern Nigeria writes the London Times as follows:

In the northern part of Zaria and in Kano the science of agriculture has attained remarkable development.

There is little we can teach the Kano farmer. There is much that we can learn from him. Rotation of crops and green manuring are thoroughly understood, and I have frequently noticed in the neighborhood of some villages small heaps of ashes and dry animal manure deposited at intervals along the crest of cultivated ridges, which the rains will presently wash into the waiting earth. In fact, every scrap of fertilizing substance is husbanded by this expert and industrious agricultural people.

Instead of wasting money with the deluded notion of "teaching modern methods" to the Northern Nigerian farmer, we should be better employed in endeavoring to find an answer to the puzzling question of how it is that land which for centuries has been yielding enormous crops of grain, which in the spring is one carpet of green and in November one huge cornfield "white unto harvest", can continue doing so. What is wanted is an expert agriculturist who will start out not to teach but to learn, who will study for a period, of, say, five years the highly complicated and scientific methods of native agriculture, and base suggested possible improvements for labor-saving appliances upon real knowledge.

RUBBER IN BRAZIL.

Encouragement by the Government for the planting of rubber in the State of Para, Brazil, has already resulted in the setting out of many thousands of Para trees. Awards will be given

to planters of this famous species and during the next four years it is estimated some 6 million trees will be in evidence in modern plantations.

Some eight years ago the first ball of Para rubber, collected from cultivated trees in Brazil, was shipped to one of the rubber experts of the United States Department of Agriculture at Washington, D. C. It was some 60 centimeters in diameter, and gave off such a bad odor that it was passed around from one office to another as a sort of "white elephant" for some time after its arrival. This unpleasant effluvium in fresh balls of Para rubber is due to the decomposition of the vegetable juices retained in the tissue of the rubber itself; even Castilla rubber in blocks, although carefully prepared, frequently has a pronounced odor, like that of an unventilated cow stable. In sheets this odor is, of course, not noticeable.

The new railway which Brazil is constructing around the falls of the Madeira and Mamore Rivers will open up an immense new field to the rubber collectors. This new road enters the "buffer state" of Acre, which was for some time a disputed territory between Bolivia and Brazil. It will probably be open for traffic by the middle of 1912, and it is expected that it will not only increase Brazil's output of wild rubber by some 20 to 30 per cent, but will also give the rubber district of Bolivia a new direct outlet by rail instead of over the extremely dangerous rapids of the aforesaid rivers as heretofore. This will, of course, be a strong factor in the gradual if not rapid reduction of the price to the problematical "rock bottom rate of 2 shillings per pound." As soon as rubber can be had in unlimited quantities for ₧1, or even ₧1.50 per kilo, the world will have another new delight—that of walking on rubber floors and rubber pavements.

PLANT PESTS AND DISEASES.

Cuba is rapidly losing her coconut industry, some localities having already lost about 76 per cent of their trees from bud-rot. Nearly all countries are greatly troubled by the rat pest. All the Orient is suffering from the red weevil and the black beetle, although in the Philippines there is comparatively very little damage done by either of these two insects. In Malaya, India, and the East Indies, a fungus disease, known as the "stem-bleeding fungus" (*Thielaviopsis ethacetica*) is causing considerable damage but does not appear to be present, thus far, in the Philippines.

A root disease, supposed to be caused by a *Botryodiplodia*,

affects about one-fifth of the North Travancore district in India where about 100,000 hectares are in coconuts, and in this area the percentage of attacked palms runs from 5 to 75 per cent. A very serious root disease, as well as "bud-rot," also occurs in Trinidad, British West Indies.

A leaf-eating coconut caterpillar is very prevalent in some parts of Malaya and India.

In comparison, then, with the principal coconut-growing countries of the world, the Philippines are exceptionally fortunate in having almost no serious diseases or pests. The "bud-rot," however, should be exterminated as soon as possible, a matter of no great difficulty, providing all the planters in an affected district cooperate to that end. The black beetle will probably always be with us in the Philippines but by leaving a tree here and there to be tapped for tuba, the insects can be caught in or around the tuba tree, since they are attracted by the smell of the fermenting sap. The same method is to be recommended for exterminating the red weevil which, fortunately, appears to be very rare. By means of tuba tapping and careful and continual search for infested trees (and immediate destruction of same when found), this red weevil could be practically exterminated within two years. The only thing to be feared in this line is that the insect *may* exist in wild palms, such as the Buri, Cabo Negro, and others.

A NEW METHOD OF PROPAGATING MANGOS, ETC.

In a recent bulletin¹ of the United States Department of Agriculture, Washington, D. C., a new method of propagating mangos, mangosteens, etc., is recommended. Much difficulty has been had heretofore with the growing of these and similar fruits in the propagating greenhouses of the Bureau of Plant Industry at Washington, D. C., and this new "nurse-plant" method, which consists in inarching a very young seedling onto the stem or branch of an older plant, has several points in its favor in greenhouse work.

The bulletin states, however, that:

These methods are inexpensive and, owing to their simplicity, may be used by persons without previous experience in the propagation of plants * * *. The most remarkable feature of the new methods lies not only in their simplicity but also in the certainty of the unions which result.

¹The Seedling-Inarch and Nurse-Plant Methods of Propagation. By Geo. W. Oliver, Bulletin No. 202, U. S. Dept. of Agri., Bureau of Plant Industry, Washington, D. C.

It would seem that the author's idea applies only to greenhouse conditions where there is a constant high humidity that prevents the rapid and fatal drying out of the balls of earth around the seedling roots and also damage by wind movement (which would, of course, seriously interfere with the healing of the cut surfaces). Hence it unfortunately will probably be impracticable to apply this method, at least in the Tropics, to outdoor plant propagation work, excepting in small nurseries where expert labor can be had, and then only with valuable plants.

NEW EMPLOYEES FOR THE BUREAU OF AGRICULTURE.

Among the recent appointees to the Bureau of Agriculture are Messrs. H. T. Nielsen, Henry H. Boyle, and F. C. Kingman.

Mr. Nielsen comes to the Islands to assume the duties of forage expert for the Bureau of Agriculture. He is a graduate of the Kansas Agricultural College (1903), and has taken postgraduate work in farm crops and agricultural engineering at the Iowa Agricultural College. From 1904 to 1909 Mr. Nielsen held a position as scientific assistant in agronomy with the United States Department of Agriculture, being for three seasons in charge of the work on grasses and other forage crops at the Arlington experiment farm near Washington. In 1906 he was sent to Arizona and California to study the problem of leguminous cover crops for orchards. During the next two years his work was entirely in the southern states encouraging the home production of forage and the establishment of definite crop systems on the farms; later on he was employed as lecturer by the Kansas Agricultural College, afterwards accepting a position at the Kansas experiment station as assistant in coöperative experiments, being engaged in this work until his departure for the Philippines.

Mr. Boyle's first training was as an apprentice in a nursery in the District of Columbia, where he received a good education in nursery, greenhouse, and farm management. In 1901 he accepted a position in the Bureau of Plant Industry, United States Department of Agriculture, as a student assistant, from which he was promoted later to the position of expert in the propagation of tropical plants, trees and shrubs. In connection with the work on mangos and citrus propagation he was sent several times to Florida and Georgia. In 1907 he was sent by the Department to Great Britain and Ireland, in connection with the introduction of new and rare plants which at that time had been introduced into that country from north China.

The last three of Mr. Boyle's ten and one-half years' service in the Department were spent as assistant arboriculturist in the crop physiology and breeding investigations.

Mr. Kingman is a graduate of the West Des Moines High School, Des Moines, Iowa, and of the Iowa State College (1911) at Ames, Iowa. He has taken special work in soils and soil analysis and has had considerable experience in practical farm work.

BOOK REVIEWS.

By W. O. BARRETT,

Chief, Division of Experiment Stations.

PRACTICAL BOTANY.

(Published by Ginn & Co.)

For several years the practical horticulturist and cropgrower has been in need of a botany which was something better than a check-list or a scientific compilation of more or less theoretical questions and discussions of nomenclature. *Practical Botany*, by Professors Joseph Y. Bergen and Otis W. Caldwell, has over 500 pages of excellent text, beautifully illustrated, and containing a glossary of the scientific terms which might not be understood by the average agriculturist. The wealth of subject material is amazing; not only is the reader made to understand precisely *what plants are* and just how they grow and reproduce themselves, but the great groups of plants are dealt with in a very interesting style and the uses of the principal plants which make animal life pleasant or possible on the earth's surface to-day are treated in such a manner that the reader is fascinated by the procession of amazing facts and the unlooked-for explanations of common mysteries.

The authors have been very fair to the Tropics, and, in fact, to all countries where agriculturists are interested in practical botany; indeed this admirable book should be just as valuable in Cape Colony, or India, as in Europe and America. The up-to-date farmer who wishes to know what his plants are and to look at difficult problems of life, from *their* point of view, so to speak, cannot afford to be without this book. The student, too, will find information in it which would take him a long time to obtain from the standard botanies and biological reference books. Briefly, then, it is not only fresh and accurate, but exceedingly interesting and thoroughly practical.

PRINCIPALS OF RURAL ECONOMICS.

This work, by Thomas Nixon Carver (Ginn & Co., Publishers), is one of the best of the new books on agriculture, in a broad sense, as the world sees it to-day. It contains some 386 pages, but is unfortunately devoid of illustrations which, we believe, might have improved the text of the work. In this book there is scarcely a feature of modern ecology or agronomy which is not discussed in a clear, concise manner, and although the author has evidently made an attempt to avoid the deeply scientific matters, the really important ideas—even of very recent discoveries—affecting the scientific basis of agricultural principles, are well brought out.

For those who are interested in the history of the development of modern agriculture in America, the author has given a very interesting sketch of this subject in the second chapter, and the reader is carried back into the dim vistas of prehistoric civilization in such a way that before he realizes it he is getting important sidelights on the origin of crop cultivation and animal husbandry; clear paths are cut through the complex mazes of sociological problems so that he gets a correct idea, without effort, of the actual relations between the old days of the savage tribes and the precariously artificial life of the civilized communities of to-day, the economy of which is fundamentally rural and even depends more or less directly upon the vegetable and animal products of that greatest of all practical scientists—the farmer.

MONTHLY CROP CONDITIONS—NOVEMBER.

ABACA.

Albay.—The general condition of the fields is fair, though very little is being harvested at present on account of the rainy season and the present low price.

Ambos Camarines.—The output of abaca seems about the same as usual, except that there is a noticeable improvement in the grades produced.

Capiz.—The general condition of the fields is unsatisfactory; no damage has been done by storms; present price from 16 to 22 centavos per kilo.

Samar.—The present outlook for this crop is excellent, and considerable harvesting is being done.

COCONUTS.

Albay.—Copra seems to be the principal business in the town of Tobaco at present as the price remains steady at ₱16.75 per 100 kilos. This industry has increased 60 per cent over that of three months ago.

Ambos Camarines.—Considerable output of copra is still going on and there is a considerable amount of new plantings. No coconut pests have been reported in this section except a few isolated cases of beetles.

Samar.—Some damage has been suffered from an insect which destroys the leaves of the trees, but generally speaking they are in good condition.

CORN.

Batangas.—The corn crop is a failure throughout practically all the province.

Ilocos Norte.—Owing to the shortage of the rice crop the people are busy planting corn as a substitute.

Ilocos Sur.—No rain has fallen since the last baguio, September 30, and corn cannot be planted on account of the dry condition of the ground.

Isabela.—Owing to the extremely dry weather that has prevailed here during the months of October and November the farmers have been unable to plant their corn crop. However,

a considerable amount of corn still remains on deposit in the southern parts of the province.

Oriental Negros.—Corn is in very good condition and harvesting will soon begin.

Samar.—Considerable planting has been done during the month with the seeds distributed by the Provincial Governor, and according to reports these plantings are in very good condition.

RICE.

Albay.—Rice harvesting and planting are going on simultaneously in the Ligao-Libon district. While crops planted in June and July last are good with large full heads of rice, those planted later have suffered from the continued dry weather, and do not promise as well as the earlier harvest. The rats have damaged the crops in Libon and Polangui during the month, and the want of rain has caused serious loss in the crops of mountain rice along the west coast where usually sufficient rice is grown to maintain the people of that section without the necessity of buying imported grain.

Ambos Camarines.—Ambos Camarines has suffered a loss of almost, if not quite, 60 per cent of the rice crop of the Bicol River valley from the long dry weather.

Batangas.—There was a very poor rice crop this year, and in many localities it is nearly consumed, and many people in different sections are living on roots and forage.

Capiz.—The rice harvest has been gathered and a very good crop made except on the Island of Tablas where there will be less than half a crop.

Cavite.—The rice crop of this province has been ruined by the continuous drought, even those lands under irrigation having suffered for lack of sufficient water.

Ilocos Norte.—The people who suffer mostly from shortage of the rice crop are the well-to-do landowners and there is no indication that a famine will menace the poorer classes. A conservative estimate after investigation shows the damage will not be less than 40 per cent and not more than 45 per cent. This loss will be felt principally by those who export rice from this province and not by the working classes.

Ilocos Sur.—The rice crop is very poor, and will at the most be about half of last year's.

The price of rice in most of the towns is now going up. In Vigan it is ₱7.

Iloilo.—Palay (unhulled rice) which in other years at this time usually costs not more than from ₱1.50 to ₱2 per 75 kilos now

averages about ₱3 and is going up. This is a very bad indication and is due to the long dry spell which has about killed all the late plantings of rice, the estimate now being a loss of about 50 per cent. This with shortage in other provinces and countries will mean much hunger.

Isabela.—During the month of November the provincial treasurer of Isabela imported 500 sacks of rice from Manila for sale to the poor and most needy people residing in several towns throughout the province at a nominal price of ₱6.80 per sack. At the present writing the Chinese merchants have a good supply of this product on hand which they are selling at the rate or ₱7.50 to ₱8.50 per sack, according to the quality.

La Laguna.—The dry land rice in the foot hills has been harvested. It was an average crop. It matured before the dry weather could affect it, but as there is but a small amount of ground along the foot hills where rice is cultivated, the total product is small.

The low land is in need of water. The crop in San Pedro Tunasan has been completely killed by the drought. In Biñan, Santa Rosa, and Calamba, the crop will be very short due to the lack of water.

It is yet too early to estimate the crop of this year, but if there are no more rains it will fall far below the average.

La Union.—There is no doubt that the rice crop is less than one half the usual amount and the people are already becoming restless. There is a "clique" of seven prominent men in the northern part of the province who are planning to make a pool of some ten thousand pesos and import rice directly from Saigon to be re-sold at a profit to the people.

Nueva Ecija.—Owing to lack of rains the rice crop will be short 60 to 80 per cent.

Nueva Vizcaya.—During the month of November no rain has fallen. The rice fields in Badcaran and parts of Bagabag are extremely dry. Nevertheless the palay crop looks promising, and it is expected that harvesting will commence in January. The palay in the Dupax district is excellent. The mountain palay in the rancheria of Campote, Tungud and Tayupay is of very good quality.

Occidental Negros.—Good rice crops are reported in northern part of province and in La Carlota district. The town of Isabela reports rice crop doubtful, owing to dry weather.

Oriental Negros.—Dry weather has practically ruined the rice crop in Tolong and Siaton and great shortage of this staple will be felt this year in southern Negros.

Rizal.—The recent protracted drought has caused a total failure of the rice crop in this province. In large areas there will be absolutely no harvest, and even in those favored localities where water was obtainable for irrigation purposes the crop is going to be far short of an average yield. The most expert opinion on this subject places the prospective yield of this year's crop at about ten per cent of that of former years, scarcely enough to pay for the seed.

Samar.—The price of rice, which last month reached the high water mark of ₱10.50, continues to fall. In a way, the rise in the price of rice, which put it beyond even the most well-to-do people, worked for good, as it gave stimulus to the planting of camotes and other vegetables.

Tarlac.—The rice crop in these municipalities is in a hopeless condition. Flood after flood has destroyed the biggest portion of rice planted as late as September and what was saved from the destructive action of water is now dying on account of long drought. No rain has fallen after the last flood of September and there is not even a bad system of artificial irrigation to save this crop from total loss. It will not be exaggerated to put at 75 or even 80 per cent the loss of the rice crop this year for lack of water.

Tayabas.—Conditions in regard to harvesting rice are very unfavorable due to the extreme drought during the last two months. The crops in the Tiaong district have been a complete failure. In this section prices have reached from ₱10 to ₱12 per 75 liters, although in Manila it is quoted at ₱7. In the Atimonan district, however, rice seems to be plentiful and the price there is about the same as in Manila.

SUGAR CANE.

Antique.—The drought is now seriously interfering with the planting of sugar cane. From San Jose to Tibiao there has been practically no rain for seven weeks.

Bataan.—Sugar cane is in very good condition throughout the province, although at present it is too dry to begin planting the new crop.

Batangas.—The dry weather is beginning to damage the standing cane and milling has already begun.

Bulacan.—The growing crop has been damaged considerably by drought, and no land can be prepared for future planting owing to the lack of rain.

Iloilo.—Sugar milling has commenced and the price is high

due probably to the fact that purchasers do not want sugar in small lots as it is at present offered.

La Laguna.—The sugar cane is looking well in all parts of this province, and much plowing is being done in the uplands preparing the ground for early planting.

Occidental Negros.—Milling has begun on the western coast; the yield is less than that of last year but the quality is better; with the increase in price the total value of this year's crop will probably equal, if not exceed, that of last year.

Oriental Negros.—Near Bayauan sugar cane is in bad condition owing to the excessive rains of several months ago. In the vicinity of Bais the cane is doing well; more hectares are under cultivation here this year than last.

MARKET REPORTS.

NOTES ON MANILA MARKETS FOR NOVEMBER.

By **KER & Co.**

(Based on advices from New York, November 3; San Francisco, November 8; London, November 18; Hongkong, December 10; Iloilo, December 12; Cebu, December 9.)

SUGAR.

Market dull. Arrivals do not come up to expectations. Sugar apparently being held back by planters. We quote ₱8 per picul first cost for No. 1, nominal.

MANILA HEMP.

During the past fortnight market has been quiet but steady for better grade and although for lower grades market was easier, at the close tone all round is better. Arrivals of free Hemp of better grades are small and we quote ₱15.50 for good current say £30/10/- per ton f. o. b., for U. S. current ₱8.50 and U. K. ₱8 per picul first cost or say £18/15/- and £17/15/- per ton f. o. b. Arrivals at all ports for the fortnight were 42,979 bales.

COPRA.

Market for Cebu f. m. s. has been steady at ₱11.50 or say £21/10- per ton f. o. b.; Manila f. m. unchanged—sales made at ₱11 per picul or £20/5/- per ton f. o. b.; market closes rather quieter.

LONDON FIBER MARKET.

The following prices for Manila hemp, sisal, and maguey were quoted by Messrs. Landauer & Co., London, November 22, 1911.¹

Manila hemp.—Receipts for the week are cabled as 26,000 bales against 23,000 bales for the corresponding week last year.

The market for fine hemp has ruled quite steady. Shippers

¹ These quotations are in pounds and shillings English currency per ton. One pound equals about 10 pesos Philippine currency. One ton equals approximately 16 piculs.

have shown little interest as sellers, but on the other hand, buyers are quite apathetic, and are not prepared to increase their stocks at present prices. Value on old contract terms £34 to £34/10—good current, £36 to £39 good marks, and £40 to £43 for primest marks.

Range of prices.

Grades.	Spot and close by.		
	Per ton.	Per ton.	Per picul.
Best marks	40/- -43/-	₹400.00-₹430.00	₹25.00-₹26.90
Good marks	38/- -40/-	380.00-400.00	23.75-25.00
Good current	34/- -34/6	340.00-343.00	21.25-21.43
25 per cent over current	22/- -22/6	220.00-223.00	13.75-13.95
Fair current	20/- -20/3	200.00-201.50	12.50-12.59
Superior seconds	19/6 -19/9	193.00-194.50	12.10-12.16
Good seconds	19/3 -19/6	191.50-193.00	11.97-12.10
Fair seconds	19/- -19/3	190.00-191.50	11.85-11.97
Good brown	18/- -19/-	184.50-190.00	11.55-11.85
Fair brown	18/- -19/-	184.50-190.00	11.55-11.85

Sisal hemp.—Dull. The price in New York is 4½ cents, equal to £22-10/- to £22-15/- c. i. f. Europe. Trifling quantities in store quoted at £23.

Manila maguay fiber.—Steady. We quote No. 1 Cebu at £19, ordinary No. 1 at £16, No. 2 at £15 and No. 3 at £13-15/.

MANILA AND LONDON FIBER MARKET.

Receipts and shipments of Manila hemp.

[Telegram from Manila to London, December 26, 1911.]

	1911	1910
Hemp receipts at:	<i>Bales.</i>	<i>Bales.</i>
Manila since January 1	981,826	1,016,845
Cebu, etc., since January 1	255,466	301,139
All ports since January 1	1,237,292	1,317,984
Shipments by steamers to:		
United Kingdom, cleared since January 1	468,480	529,637
Atlantic coast, United States, cleared since January 1	359,762	467,369
Pacific coast, United States, cleared since January 1	164,311	105,555
Continental ports, cleared since January 1	98,594	88,252
Shipments to:		
All other ports	71,147	
Local consumption since January 1	26,920	
	98,067	71,359
Loading steamer on the berth for:		
United Kingdom, about	30,000	37,000
Atlantic coast, United States, about		28,000
Pacific coast, United States, about	5,000	
Shipments per sailer to Atlantic coast, United States, since January 1		20,650
Bales of hemp loading for United Kingdom, by steamer:		
Birkenfels		30,000
Bales of hemp loading for Pacific coast, by steamer:		
Suveric		5,000

ILOILO SUGAR MARKET.

The arrivals of sugar in Iloilo from the mills and sugar districts in the month of November were 25,805 piculs.

During the month of November the price of sugar remained constant at 8 pesos 2 reales¹ from the 1st to the 13th, when it dropped to 7 pesos 7 reales; on the 14th there was a still further decline to 7 pesos 4 reales, at which figure it remained constant until the end of the month.

¹ One real equals 18½ centavos.

CROPS PLANTED AND HARVESTED AND CONDITION OF SAME TAKEN FROM QUARTERLY CROP REPORTS FOR THE QUARTER ENDING JUNE 30, 1911.

By BENJ. P. LUKENS, *Acting Statistician.*

(NOTE.—Attention is invited to the fact that rice should be understood as being in the unhulled state. 75 liters=1 cavan; 63.25 kilos=1 picul; 46 kilos=1 quintal; 11.5 kilos=1 arroba; 0.4047 hectare=1 acre.)

Province and crop.	Condition.	Planted during quarter.	Harvested during quarter.	
			Area.	Quantity.
		Hectares.	Hectares.	
Agusan:				
Rice	Good	594	1,735	853,950 liters.
Sugar	Fair	2	3	759 kilos.
Corn	Fair	70	105	94,200 liters.
Abacá	Good	5	1,839	455,780 kilos.
Copra	Good			41,492 kilos.
Albay:				
Rice	Fair	3,168	2,657	3,412,275 liters.
Sugar	Fair	39	58	87,285 kilos.
Corn	Fair	1,005	184	113,775 liters.
Abacá	Good	1,493	26,934	6,742,197 kilos.
Copra	Fair			2,695,715 kilos.
Cacao	Fair	2	26	3,868 kilos.
Ambos Camarines:				
Rice	Fair	1,753	12,392	19,227,300 liters.
Sugar	Fair	110	262	109,422 kilos.
Corn	Fair	237	164	72,000 liters.
Abacá	Good	243	22,802	6,096,098 kilos.
Copra	Good			692,398 kilos.
Cacao	Poor		51	6,498 kilos.
Antique:				
Sugar	Good	656	958	1,061,588 kilos.
Tobacco	Fair		78	18,068 kilos.
Corn	Good	692	727	665,250 liters.
Abacá	Good	78	42	23,023 kilos.
Copra	Fair			21,758 kilos.
Bataan:				
Rice	Fair	247	359	1,125,750 liters.
Corn	Fair	211	22	38,620 liters.
Batanes:				
Rice	Fair	10	8	2,400 liters.
Tobacco	Good		13	1,380 kilos.
Corn	Fair	29	20	19,275 liters.
Batangas:				
Rice	Fair	19,416	228	438,670 liters.
Sugar	Fair	2,836	1,163	1,793,707 kilos.
Tobacco	Good		26	13,294 kilos.
Corn	Fair	7,123	244	194,400 liters.
Abacá	Good	13	60	15,433 kilos.
Copra	Fair			21,758 kilos.
Cacao	Fair	7	7	2,185 kilos.
Bohol:				
Rice	Fair	3,942	17,061	9,016,875 liters.
Sugar	Fair	596	98	35,420 kilos.
Tobacco	Fair		135	45,460 kilos.
Corn	Fair	4,894	1,214	1,305,450 liters.
Abacá	Fair	6	498	220,047 kilos.
Copra	Good			1,750,570 kilos.
Maguey	Good	10	95	27,261 kilos.

Crops planted and harvested, etc.—Continued.

Province and crop.	Condition.	Harvested during quarter.	
		Area.	Quantity.
		<i>Hectares.</i>	<i>Hectares.</i>
Bulacan:			
Rice	Fair	1,372	5,954
Sugar	Fair	1,082	87
Tobacco	Fair		13
Corn	Fair	1,903	192
Cagayan:			
Rice	Fair	3,937	1,441
Tobacco	Fair		7,361
Corn	Fair	51,464	3,314
Capiz:			
Sugar	Good	144	88
Tobacco	Fair	12	280
Corn	Fair	1,270	1,134
Abacá	Fair	145	705
Copra	Fair		
Cavite:			
Rice	Fair	4,262	796
Sugar	Fair	270	196
Tobacco	Fair		29
Corn	Fair	978	120
Abacá	Fair	218	215
Copra	Fair		
Cebu:			
Rice	Fair	1,252	1,558
Sugar	Good	933	601
Tobacco	Fair		6,875
Corn	Fair	66,964	7,794
Abacá	Fair	95	1,735
Copra	Good		
Maguey	Good	384	1,095
Cacao	Poor	9	76
Ilocos Norte:			
Sugar	Fair	637	502
Tobacco	Fair	80	1,882
Corn	Fair	671	718
Ilocos Sur:			
Rice	Fair	1,039	299
Sugar	Good	904	710
Tobacco	Fair		701
Corn	Fair	1,783	1,713
Maguey	Good	66	1,526
Iloilo:			
Rice	Good	22,540	770
Sugar	Good	4,754	1,584
Tobacco	Fair		927
Corn	Fair	3,359	1,673
Abacá	Good	261	374
Copra	Good		
Isabela:			
Rice	Fair	170	365
Tobacco	Fair		14,250
Corn	Fair	20,122	8,434
La Laguna:			
Rice	Fair	1,646	12,818
Sugar	Good	1,097	728
Corn	Good	242	97
Abacá	Fair	92	453
Copra	Fair		
Cacao	Fair		45
La Union:			
Sugar	Fair	67	177
Tobacco	Fair		3,698
Corn	Fair	849	24
Cacao	Fair		3
Leyte:			
Rice	Fair	6,570	8,838
Sugar	Fair	238	420
Tobacco	Fair	365	2,006
Corn	Good	6,589	3,718
Abacá	Fair	756	12,188
Copra	Fair		
Mindoro:			
Rice	Fair	510	12
Tobacco	Good		50
Corn	Good	59	92
Abacá	Good	33	316
Copra	Fair		

Crops planted and harvested, etc.—Continued.

Province and crop.	Condition.	Planted during quarter.		Harvested during quarter.	
		Hectares.	Hectares.	Area.	Quantity.
Misamis:					
Rice	Good	4,410	745		435,370 liters.
Sugar	Good	15	5		10,436 kilos.
Tobacco	Fair		5		2,852 kilos.
Corn	Fair	2,980	142		49,500 liters.
Abacá	Fair	101	6,954		1,186,380 kilos.
Copra	Good				1,854,047 kilos.
Moro:					
Rice	Good	795	973		707,625 liters.
Sugar	Good	358	78		69,232 kilos.
Tobacco	Good	3	10		1,012 kilos.
Corn	Fair	213	123		94,500 liters.
Abacá	Good	360	8,103		2,028,744 kilos.
Copra	Good				586,632 kilos.
Mountain:					
Rice	Fair	541	2,637		3,350,550 liters.
Sugar	Fair	68	17		6,388 kilos.
Tobacco	Fair	506	619		160,172 kilos.
Corn	Fair	1,474	461		330,075 liters.
Nueva Ecija:					
Sugar	Fair		5		3,099 kilos.
Tobacco	Fair		484		150,926 kilos.
Corn	Good	960	34		36,100 liters.
Nueva Vizcaya:					
Rice	Poor	5	227		170,250 liters.
Sugar	Fair	68	80		54,585 kilos.
Tobacco	Fair		78		38,686 kilos.
Corn	Fair	76	113		44,100 liters.
Occidental Negros:					
Rice	Good		200		150,000 liters.
Sugar	Fair	9,959	13,029		25,179,066 kilos.
Tobacco	Fair		1,033		607,430 kilos.
Corn	Good	5,379	590		273,750 liters.
Abacá	Fair	43	810		116,317 kilos.
Copra	Good				248,319 kilos.
Oriental Negros:					
Rice	Fair	69	86		129,450 liters.
Sugar	Fair	396	1,333		1,918,056 kilos.
Tobacco	Fair		347		201,434 kilos.
Corn	Fair	10,716	1,139		554,550 liters.
Abacá	Fair	174	790		514,539 kilos.
Copra	Fair				636,548 kilos.
Palawan:					
Tobacco	Fair		10		1,656 kilos.
Copra	Good				77,418 kilos.
Pampanga:					
Rice	Fair	3,662	6,714		11,644,275 liters.
Sugar	Fair	6,116	1,498		2,319,504 kilos.
Tobacco	Good		52		24,840 kilos.
Corn	Fair	8,053	228		149,250 liters.
Pangasinan:					
Sugar	Fair	375	48		15,053 kilos.
Tobacco	Fair		5,439		2,391,034 kilos.
Corn	Fair	10,348	1,189		2,875,425 liters.
Copra	Good				795,116 kilos.
Maguey	Fair	28	99		31,335 kilos.
Cacao	Fair	17	67		59,110 kilos.
Coffee	Poor	12	64		1,483 kilos.
Rizal:					
Rice	Fair	1,103	1,620		3,562,750 liters.
Sugar	Fair	1,509	263		234,404 kilos.
Tobacco	Fair		7		3,634 kilos.
Corn	Fair	1,329	270		186,075 liters.
Samar:					
Rice	Fair	3,463	9,364		13,048,875 liters.
Sugar	Good	598	138		36,685 kilos.
Tobacco	Fair	49	376		98,772 kilos.
Corn	Good	1,700	279		390,375 liters.
Abacá	Good	8,559	6,372		2,444,360 kilos.
Copra	Fair				460,587 kilos.
Sorsogon:					
Rice	Fair	1,179	9,338		8,529,525 liters.
Sugar	Good	88	136		84,692 kilos.
Tobacco	Good		165		36,708 kilos.
Corn	Fair	847	414		217,725 liters.
Abacá	Good	227	14,512		3,063,078 kilos.
Copra	Good				87,412 kilos.

Crops planted and harvested etc.—Continued.

Province and crop.	Condition.	Planted during quarter.	Harvested during quarter.	
			Area.	Quantity.
		<i>Hectares.</i>	<i>Hectares.</i>	
Surigao:				
Rice	Fair		12,859	8,925,450 liters.
Sugar	Fair	88	137	58,127 kilos.
Tobacco	Good	71	23	7,774 kilos.
Corn	Good	1,645	316	231,075 liters.
Abacá	Good	147	1,840	504,609 kilos.
Copra	Good			143,894 kilos.
Tarlac:				
Rice	Fair	4,200	14,288	19,695,000 liters.
Sugar	Good	2,055	61	39,658 kilos.
Tobacco	Good	25	73	33,994 kilos.
Corn	Fair	989	769	282,000 liters.
Tayabas:				
Rice	Fair	7,222	13,303	3,534,425 liters.
Sugar	Good	141	296	280,387 kilos.
Tobacco	Fair		200	95,220 kilos.
Corn	Fair	332	420	201,050 liters.
Abacá	Good	102	420	179,377 kilos.
Copra	Good			3,041,882 kilos.
Zambales:				
Sugar	Good	61	32	33,323 kilos.
Tobacco	Fair		46	24,702 kilos.
Corn	Fair	93	36	14,025 liters.
Maguey	Fair	8	15	10,436 kilos.

RANGE OF PRICES OF PHILIPPINE AGRICULTURE PRODUCTS.

By BENJ. P. LUKENS, Acting Statistician.

Highest and lowest prices of unhulled rice, corn, sugar, tobacco, abaca, and copra for quarter ending June 30, 1911.

[NOTE.—75 liters=1 cavan; 63.25 kilos=1 picul; 46 kilos=1 quintal.]

Provinces.	Unhulled rice (per 75 liters).		Corn (per 75 liters).		Sugar (per 63.25 kilos).		Tobacco (per 46 kilos).		Abaca (per 63.25 kilos).		Copra (per 63.25 kilos).	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
Agusan	4.50	2.25	2.50	1.50	10.00	4.50	20.70	8.28	10.00	6.32	9.48	6.32
Albay	3.75	1.50	4.00	1.50					12.00	5.69	11.38	5.06
Ambos Camarines	4.00	3.00	2.25	1.50	9.48	6.32			7.59	5.00	10.25	3.06
Antique	3.00	1.87	3.75	1.50	9.00	6.32	11.50	8.28	17.70	7.59	9.48	7.59
Bataan	4.50	1.50	4.50	2.25								
Batanes	3.50	2.25	4.00	2.25	9.48	3.80	9.20	8.28	17.00	16.00	13.91	6.32
Batangas	4.50	2.50	4.50	1.50	9.48	3.80	23.00	5.52	12.00	6.32	10.75	7.00
Bohol	3.00	2.25	4.50	2.00	7.59	4.45						
Bulacan	3.00	2.25	3.00	1.50			25.30	6.90				
Cagayan	3.25	3.00	3.75	1.50	8.55	4.43	23.00	4.60	18.00	5.98	9.00	5.69
Capiz	3.37	2.25	3.75	1.50	8.22	4.43	23.00	5.52	19.00	16.44	11.38	5.06
Cebu	4.50	2.50	4.00	1.50			10.00	4.60	13.28	6.95	11.38	5.06
Ilocos Norte	4.50	2.50	4.00	1.50	5.50	4.00	23.00	3.98	15.81	11.96	11.00	6.32
Ilocos Sur	3.75	2.50	3.75	2.00	9.48	5.00	20.00	3.98				
Iloilo	3.20	3.00	3.00	3.00	10.00	6.32	10.00	4.60	7.59	5.06	9.48	6.32
La Laguna	3.75	2.00	4.00	2.25	4.43	4.43	27.60	13.80	11.38	4.50	8.22	6.00
La Union	3.75	1.87	4.00	2.25	6.32	4.43			13.91	7.59	10.12	5.69
Leyte	4.50	2.00	3.75	2.00					11.38	5.06	10.12	8.85
Mindoro	3.75	2.00	3.75	1.50					13.28	6.95	12.65	8.85
Misamis	4.50	2.25	4.00	1.50								
Moro	3.75	1.91	3.75	2.25			23.46	4.60				
Mountain	3.00	2.25	2.50	1.50	10.00	5.06	17.00	5.52				
Nueva Ecija	3.75	2.00	4.00	1.50			23.00	11.00	17.00	7.59	12.00	5.06
Nueva Vizcaya	4.50	2.25	3.75	2.00	8.22	5.06			13.91	5.06	10.75	7.59
Ocidental Negros	4.12	2.25	3.75	2.00	6.35	5.06			13.91	5.06	7.59	5.06
Oriental Negros	3.50	2.25	3.25	2.50								
Palawan	3.00	2.25	2.50	1.50								
Pampanga	3.37	2.25	2.57	1.50	6.95	3.80	13.80	10.00				
Pangasinan	3.50	1.75	4.50	1.50	10.12	3.80	23.00	4.60				
Rizal	3.00	2.25	3.00	1.75	8.00	4.43						
Samar	3.75	1.87	3.00	2.50	7.59	6.32	25.00	6.90	12.65	7.59	8.22	5.06
Sorsogon	3.75	2.25	3.00	2.25			23.00	9.20	17.08	7.59	9.48	6.32
Surigao	3.75	2.25	3.00	2.25					11.38	5.69	8.85	7.59
Tarlac	3.50	1.50	4.50	1.50	8.22	3.80						
Tayabas	4.50	1.50	4.50	1.50			18.40	5.98	16.00	5.69	8.60	4.25
Zambales	2.50	2.25	3.00	2.25			12.00	11.00				

PRINCIPAL PHILIPPINE IMPORTS AND EXPORTS— NOVEMBER.

By the COLLECTOR OF CUSTOMS.

IMPORTS.

		Manila.	Cebu.	Iloilo.	Total.
Rice	{Kilos	3,805,243	193,492	862,464	4,861,199
	{Value	\$211,297	\$8,171	\$33,617	\$253,085
Beef cattle	{Number	2,101		190	2,291
	{Value	\$45,868		\$4,815	\$50,683
Eggs	{Dozens	348,904		288	349,192
	{Value	\$27,509		\$39	\$27,548
Sugar	{Kilos	127,274	11,560	34,607	173,441
	{Value	\$10,845	\$1,154	\$3,001	\$15,000
Coffee	{Kilos	38,639		317	38,956
	{Value	\$14,650		\$190	\$14,840
Cacao	{Kilos	44,049		3	44,052
	{Value	\$14,981		3	\$14,984
Raw cotton	{Kilos	35,509		3	35,509
	{Value	\$10,838			\$10,838

EXPORTS.

Hemp	{Kilos	11,601,226	3,728,587		15,329,813
	{Value	\$1,118,592	\$376,854		\$1,495,446
Copra	{Kilos	20,484,539	7,469,929	959,901	28,914,429
	{Value	\$2,189,167	\$790,778	\$94,728	\$3,074,673
Sugar	{Kilos	3,556,048		5,735,918	9,291,966
	{Value	\$237,978		\$321,315	\$559,293
Cigars	{Number	14,626,796			14,626,796
	{Value	\$213,449			\$213,449
Cigarettes	{Number	1,903,050			1,903,050
	{Value	\$2,273			\$2,273
Tobacco	{Kilos	1,303,676			1,303,676
	{Value	\$218,050			\$218,050

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

By the DIRECTOR OF THE WEATHER BUREAU.

NOVEMBER, 1911.

[Temperature and total rainfall for twenty-four hours beginning at 6 a. m. each day.]

Date.	Hemp.				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.		Temper- ature.	Rain- fall.	Temper- ature.	Rain- fall.	Aparri.		San Fernando.	
	Temper- ature.	Rain- fall.	Temper- ature.	Rain- fall.					Temper- ature.	Rain- fall.	Temper- ature.	Rain- fall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	28.1		26.3		25.7	5.1	28.3	3.6	26.2	1.0		
2	26.1	2.9	26.9	10.5	26.9		27.8		25.5			
3	26.5	3.6	26.5		26	3.3	27.2		25.8	4.8		
4	26.2		26.3		26.1		27.2		25.2	.5		
5	26.4		26.4		25.6		26.2		25.5	.3		
6	25.2	5.3	26.1		25.5		25.7		25.5			
7	24.2	7.1	26.4		26.3	10.2	26.5		23.9	1.4		
8	25.4		26.4		26.1		26.4		24.4			
9	26.3		26.3		26.5		26.9		24			
10	26.8		26.4	3.8	26.2		26.6		22.2			
11	26.3		25.9		25		25.8		22.4			
12	25.2	7.4	26		25.2		26		23.2			
13	26.5	5.6	25.8		26.5	25.1	25.4		23.9	3.3		
14	27.3		26	11.3	25.7	3	26.2		24.2			
15	26.5	19.5	26.1		8.6	26.4	26.4		24			
16	26.3	12	26.6		8.3	27.2	.3	27.6	25.2			
17	27.7	3.3	25.2		20.5	26.8	1.8	26.2	24.8	.8		
18	26.5	8.4	25.4		8.1	26.3	2.9	27	24.6			
19	27.2	14	25.8		4.6	26.8		27.1	24.5			
20	27.2	22	26		3.8	27	2	26.8	23.9	1.3		
21	27.1	30.7	26.2		4.5	27.3		27.5	25.1			
22	27.7		26.8		10.7	27		26.8	25.2			
23	27.9	1.8	27		27.1	.8	26.6		25.6	2.8		
24	27.2	4.1	26.6		7.6	27.5	27.6		25.2	20.4		
25	27	3	26.3		11.7	26.9	26.7		25.1			
26	26.9		26.2		3.1	26.3	2.3	26.3	24.7			
27	26.4	1	26.8		1.8	25.6	2.8	26	24.2			
28	26.6		26.6		5.6	26.5		26.6	25.2			
29	27.6	4.3	26.7		6.4	26.4	.5	25.6	25			
30	25	28.4	25.8		4.8	24.7	11.9	26	25.4			

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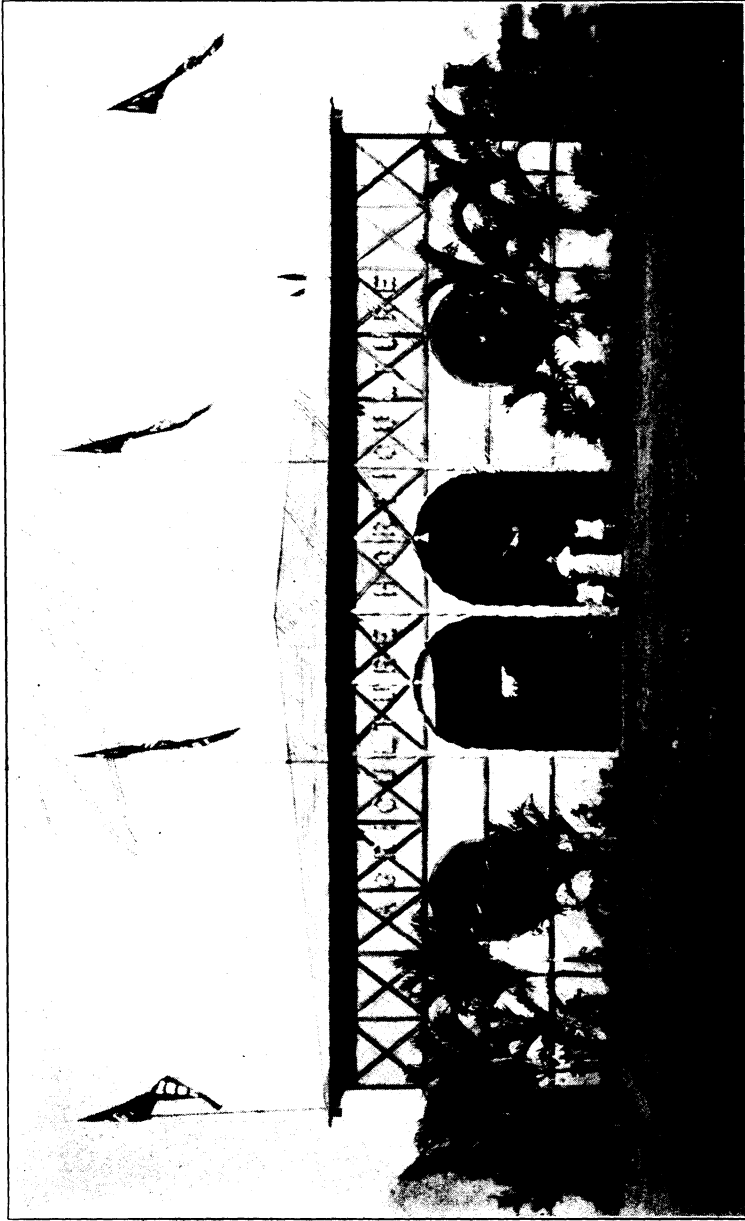
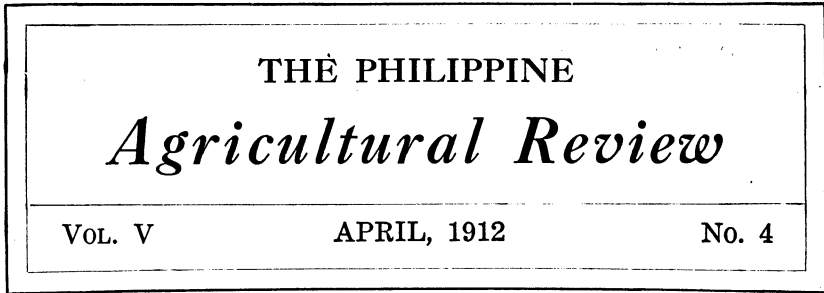


PLATE I.—AGRICULTURAL-HORTICULTURAL BUILDING, FIRST PHILIPPINE EXPOSITION, 1912.

EXPOSITION NUMBER



CONTENTS AND ILLUSTRATIONS.

CONTENTS.

	Page.
Editorial	168
Insular Bureau Exhibits at the First Philippine Exposition:	
Navigation	171
Public Works	174
Health	178
Forestry	185
Printing	186
Education—	
General Exhibit	190
Vegetable Exhibit	192
Science	194
Internal Revenue	197
Agriculture—	
Agricultural-Horticultural Exhibit	199
Steam Copra Drier	204
Live-stock Show	208
Provincial Exhibits	217
Agricultural-Horticultural Awards	226
Machinery Exhibit	231
Commercial Exhibits	234
The 1912 Carnival	235
Manila Horse Show	238
Principal Philippine Imports and Exports—January.....	240
Temperature and Rainfall for Agricultural Districts in the Philippines—January.....	241

ILLUSTRATIONS.

PLATE I. Agricultural-Horticultural Building, First Philippine Exposition.....	Frontispiece.
	Facing page—
II. Storage Dam, Osmeña Waterworks, Cebu; Julian Dam, Imus, Cavite; Custom-house, Cebu; Vaughan Bridge, San Pedro Tunasan-Calamba Road, La Laguna.....	176
III. Bay-San Pablo Road, La Laguna.....	176
IV. General View of the Vegetable Exhibit, Bureau of Education.....	192
V. Interior View, Agricultural-Horticultural Building.....	200
VI. Agricultural-Horticultural Booths: Fiber Booth; Rice Booth; Corn Booth; Coconut Booth; Sugar-cane Booth	200
VII. Scenes at the Manila Horse Show: The Four-foot Brush Jump well cleared; Officers' Mounts and Hacks; Mr. José Garchitorena's Winners in the Tandems; Miss Helen Higgins' Tandem of Native Ponies.....	238

EDITORIAL.

PHILIPPINE EXPOSITIONS.

The First Philippine Exposition was opened to the public at 4 o'clock on the afternoon of February 3, 1912. It continued for a period of ten days, closing on the evening of February 12.

Considered as a whole, the Exposition was an unqualified success. The provincial and Insular exhibits, which have been formerly a part of the Carnival, were far superior to those of previous years. The new features, of which the more prominent were the machinery and commercial exhibits, were highly satisfactory and contributed in no small measure to the educational value of the Exposition. The arrangement of the grounds, the construction of the buildings, the installation of exhibits, and the supervision of the minor details of the Exposition were of a degree of excellence highly creditable to those who were intrusted with its management.

The reasons why our expositions and carnivals are held, and the direct and indirect results that are obtained, are too generally and well understood to require further discussion. It is sufficient to state that the recent Exposition demonstrated beyond question its value as an educational factor in the life of the Filipino people, that it served to promote harmony and coöperative effort, and that it was a decided stimulus to business and the various industries of the Islands.

It may be desirable, however, while the details of the Exposition of 1912 are fresh in our minds, to consider briefly certain features of this Exposition with reference to development and improvement at the next Exposition that shall be held in Manila.

It becomes more and more apparent every year that the Philippine Islands contain a wealth of material suitable for the preparation of interesting and attractive exhibits. It is evident, furthermore, that not only the inclination, but also the ability, exists among the people of these Islands to prepare exhibits worthy of much wider attention on the part of other countries than they now receive. Having demonstrated these facts, it remains only to still further improve the high standard of our exhibits already established, and then to demonstrate to the outside world the attractiveness of our Philippine expositions in such a forceful and convincing manner that our foreign visitors shall be numbered by hundreds instead of dozens.

It has been suggested, and the suggestion is worthy of consideration, that arrangements be perfected for holding in Manila every second year a midwinter exposition, that this exposition

be known and widely advertised as the *Philippine Midwinter Exposition*, and that it be open for a period of not less than two weeks. It would seem desirable that our expositions be made a permanent institution, to be held at regular and stated intervals, and there is strong argument in favor of the biennial rather than the annual exposition. The use of the designation "Philippine Midwinter Exposition" would be attractive for advertising purposes, and would tend to bring about a better understanding in other countries as to the time of year when our expositions are held. The opinion was frequently expressed that it was unfortunate that it was impracticable to continue the recent Exposition for a longer period, and it is probable that our future expositions should remain open for at least two weeks. The importance of widely and effectively advertising our expositions is too self-evident to require comment.

Among the more important means of improvement for the next Exposition, that have been brought to our attention, is the matter of separating the exhibit and sales features. Two classes of people visit an exposition, those who desire only to view the exhibits, and those who desire to make purchases. The combination in a limited space of the exhibit and sales features is most unsatisfactory. Where a part of an exhibit is on sale, the entire exhibit soon becomes disarranged and unsightly, and likewise the prospective buyer finds that an exhibit room is not a satisfactory place in which to make purchases. In nearly all of the exhibits at the 1912 Exposition a part of the material on exhibit was offered for sale. Although the greater part of such material was not removed until after the close of the Exposition, the inevitable result was that many of the exhibits soon became disordered and unattractive. The presence of both purchasers and sightseers in one building tends, also, to larger crowds than can be easily handled. It should be possible to effect an arrangement whereby all material for sale could be placed in one "sales building" under the supervision of competent salesmen. This arrangement would undoubtedly largely increase the amount of sales, and would also greatly improve conditions in the exhibit buildings.

It has been suggested that at the next Exposition one building be devoted to "household industries." Many of the visitors at our expositions are particularly interested in these industries, which include the weaving of various textile fabrics, carving, the making of hats, mats, footwear, coconut-shell products, and numerous other articles. Where this work is widely scattered throughout a large number of exhibits there is a great amount of

expensive and unnecessary duplication, and its inspection becomes a long and tiresome task that could be largely overcome by grouping all of these industries in one building.

Other matters that have been mentioned in connection with future expositions are the encouragement of more foreign exhibits, the appointment of some one person in an advisory capacity to assist in the installation of provincial exhibits, and the continued effort to avoid duplication in the different exhibits and to further develop the idea of centralization of the more important features.

The Exposition of 1912 was so far in advance of all previous efforts that it may well be considered as above criticism. This does not mean, however, that there is not still room for improvement, and we fully believe that our next Exposition will be such as to entirely remove any lingering doubts that may still exist as to the advisability of making the biennial Philippine Midwinter Exposition a permanent institution.

INSULAR BUREAU EXHIBITS AT THE FIRST PHILIPPINE EXPOSITION.

THE EXHIBIT OF THE BUREAU OF NAVIGATION.

By LAURITZ LAURITZEN,

Assistant Engineer, Bureau of Navigation.

In a country where the bulk of traffic is waterborne, as is the case with the Philippines, the construction and maintenance of adequate port works and an efficient lighthouse service is of paramount importance.

These two spheres of governmental activity are under the control of the Bureau of Navigation, and the divisions which they form have their headquarters and shops at Engineer Island, near the mouth of the Pasig River.

The Bureau of Navigation exhibit was located at the north end of Machinery Hall. At the entrance of the building were placed two 50-foot (15.24 meters) steel towers, types of structures which are replacing the wooden towers, formerly built, as rapidly as practicable. The old wooden towers have in the past required frequent attention from repair parties, and the new steel towers reduce the maintenance cost considerably. During the past year four such towers have been erected, and the three on view at the Exposition will be sent out shortly to their designated sites.

In the main exhibit the background was filled by a large map of the Philippines, on which all existing lights were shown by small incandescent bulbs. They number 143 at present.

On the right the lighthouse division had set up a flashing apparatus of the first order. There are four lights of this size now in commission. Two are located on the north coast of Luzon at Capes Engaño and Bojeador, one is at Cabra near the entrance to Manila Bay, and the fourth at Cape Melville near the south end of Palawan.

Lights are designated by orders, according to their size and power, thus, first, second, third, fourth, fifth, and sixth. Still smaller than the sixth order is a class known as lens lanterns.

Alan Stevenson, the great Scotch lighthouse engineer, said:

Nothing can be more beautiful than an entire apparatus for a fixed light of the first order. It consists of a central belt of refractors, forming

a hollow cylinder 6 feet (1.83 meters) in diameter and 30 inches (0.76 meter) high; below it are six triangular rings of glass, ranged in a cylindrical form, and above a crown of thirteen rings of glass, forming by their union a hollow cage, composed of polished glass, 10 feet (3.05 meters) high and 6 feet (1.83 meters) in diameter. I know of no work of art more beautiful or creditable to the boldness, ardor, intelligence, and zeal of the artist.

A first-order apparatus is 12 feet (3.65 meters) high and 6 feet (1.83 meters) in diameter; a second order, 4 feet 7 inches (1.39 meters) in diameter; third order, 3 feet 3 $\frac{3}{8}$ inches (about 1 meter); fourth order, 19 $\frac{3}{8}$ inches (0.49 meter); fifth order, 14 $\frac{1}{2}$ inches (0.36 meter); sixth order, 11 $\frac{3}{4}$ inches (0.30 meter).

The distance a light can be seen is limited only by the horizon. The elevations above high water, order, and visibility of the highest Philippine lights are as follows:

Lights.	Elevation.		Order.	Visibility.	
	Feet.	Meters.		Miles.	Kilo-meters.
Corregidor.....	630	192.02	Second	33	53.11
Ambolon	446	135.54	Sixth	15	24.14
Suluán	438	133.50	Fourth	28	45.62
Apo Island.....	428	130.45	Sixth	16	25.75
Bojeador.....	386	117.65	First	26	41.84
Siatat Point.....	355	108.20	Sixth	15	21.14
Caballo	319	97.23	do	15	21.14
Cape Engaño.....	315	96.01	First	25	40.23
Batag	313	95.40	Third	25	40.23
Ungay Point.....	305	92.96	Sixth	15	21.14
Bolinao	301	91.74	Third	24	38.62
Cape Melville.....	296	90.22	First	24	38.62

The first-order apparatus on view was bought complete in France by the Spanish Government and placed by it in the tower at Capones Islands. It was afterwards removed by the Americans as of larger size than needed at that point, and a third order substituted. It is proposed to install the light in a new station to be built at Sibago Island, off Zamboanga.

On the left was shown the apparatus of a fourth-order flashing light of the newest type. The lenses are carried by a platform partially immersed in mercury. This type combines the greatest stability and durability with the minimum of power required to revolve the lighting apparatus.

These two lights are examples of flashing lights. The flash is produced by revolving the glass lenses around a stationary burner. Smaller lights are frequently occulting and several examples of this type were on view. In general, a flashing light is one in which the flash is of a second's duration or less, while an occulting light is a fixed light which at regular stated intervals suffers a total eclipse.

In an occulting apparatus, the burner and lens are both stationary and the dark periods are produced by the revolution of a metal screen between them. All occulting lights in the Philippines are of the sixth order.

There are few fixed white lights in the Philippines, since a fixed light is easily confused with a fire on shore, or the light in a fishing boat or elsewhere. Consequently it is necessary to arrange a light by means of varying lengths of dark periods, the number of flashes per minute, or otherwise, so that it may be distinguished from other lights. The characteristics of lights are carefully described in books for distribution to mariners in order that a vessel in "picking up" a light may at once know by its characteristics where the light is located.

A complete assortment of lenses, burners, chimneys, and other accessories completed this section of the exhibit.

The division of port works and lighthouse construction exhibited the large map referred to in a previous paragraph and a collection of models of work executed.

On the left was shown, first, a model of pier 5, Manila, a dock which would be a credit to any harbor in the world, and one to which ships the size of the *Manchuria* or *Cleveland* can tie up, an improvement of incalculable benefit to the business community.

Next was a model of the approach shed to pier 5. This was built in 1910 and houses various offices of the customs service. This model is on the same scale—one-twenty-fourth—as that of the dock itself.

The south and west breakwaters of Manila Harbor were represented by cross sections. Of these, the south breakwater was built entirely under American occupation. The west breakwater was completed by the division of port works, but actual work was begun by the Spanish Government in 1880, the papers in the matter having circulated between the various departments since 1833, a trifling delay of forty-seven years.

Models were also shown of the concrete harbor walls at Iloilo and Cebu, both works which have been of immense benefit to these busy shipping points.

The division of port works also has charge of the construction and repairing of lighthouse buildings, and showed three models of typical structures.

The first was a model of the Lavis Ledge light near Cebu. This station is located on a coral reef in the southern entrance of the narrow sound between Cebu and Mactan. The house is built throughout of reinforced concrete supported by concrete pillars. The roof is of concrete and is surmounted by a very graceful tower built of steel tubing, carrying the light.

The second model was that of a standard sixth-order station with occulting light. This is also a reinforced concrete building of attractive appearance. The model shows a cupola surmounting the building and carrying the light. Where local conditions require a greater elevation of the light, this cupola is omitted and the light is placed on a steel tower of the type shown at the entrance to the building. During the past year six stations of this type have been built to replace old, unsafe nipa or wooden structures. Two smaller stations of the same general appearance and construction have also been built.

Finally there was a model of a standard 20-foot (6.09 meters) reinforced-concrete beacon. This is a type of structure which has been very successful for small lights marking the entrance to ports. The simplicity of the structure, which consists throughout of reinforced concrete, makes it practically everlasting and the cost of maintenance is practically nothing. During the past year, eleven of these have been built and seven more are planned for early construction.

THE EXHIBIT OF THE BUREAU OF PUBLIC WORKS.

This exhibit, in charge of Mr. G. G. Ball, was one of the most popular in the Exposition. The attendance totaled about 200,000 persons, and on Sunday the 11th, in the afternoon, there were nearly 10,000 visitors within two hours.

The main purpose of the exhibition was to show results. Models, charts, black-and-white drawings, electric signs, and large colored and framed photographs were all used to this end.

The allotted space, while central, was small in area. It was all utilized. The interest displayed was unprecedented in the history of public works in the Philippines. Whether the visitors were Government officials, tourists, residents of Manila, or from the provinces, nearly everyone made the entire round of the several wings. Perhaps the most intense interest was displayed by people from the country. At almost any hour groups of these could be seen explaining different features to one another or comparing results in their own provinces with those elsewhere.

The Bureau began work some nine years ago as the Bureau of Engineering. The first two years were devoted to general investigations of conditions. Then the artesian-well, the bridge, the road, and the building policies were successively clearly defined and real work commenced. The Bureau was therefore at this Exposition able to show results for those four major lines of activity. The responsibilities of the Bureau have increased literally by leaps and bounds. To-day—with the municipi-

palities coming more and more to appreciate the desirability of trained advice and supervision for public improvements—it carries the responsibility for nearly all public works in the thirty-one Christian provinces and Baguio, other than port works and railroads. This comprises an area of two-thirds of the total area of the Islands, containing some nine-tenths of the total population.

The Bureau is therefore the general engineering Bureau of the Philippine Government. The work done is more varied than usually falls to the lot of similar government engineering organizations.

The classes of work include not only roads, bridges, buildings, artesian wells, and irrigation, but also such items as the operation of electric-light plants and automobile lines, plans for hydro-electric installation, water supply, sewage disposal, gas plants, and ice plants. The Bureau now contains in the neighborhood of 100 distinct organization units. It has been difficult to secure and retain a personnel, sufficiently well trained to care for these classes of work varying greatly in character, and at the same time to exhibit results to the particular government—whether municipal, provincial, or Insular—which furnished the funds. The exhibit demonstrated that the Bureau has succeeded both in following very definite lines of policy for the different classes of work and in obtaining substantial results therefrom.

The most marked showing was in road construction. Beginning in 1908 with only 487 kilometers of indifferent heavily surfaced road of many different designs, this length was not only increased 226 per cent in four years, but both the old and new work were brought to a uniform standard. On June 30, 1911, there were 1,588 kilometers of very fair heavily surfaced road, all to a single standard, well drained, and of fair line and grade. This fact in the exhibit was brought out by a large colored chart as were also the related figures on present population and length of coast line. The large colored photographs showed the new or reconstructed roads in a number of provinces. The most striking road exhibit was one illustrating progress during the year. This was a large black-and-white transparency stating that the record for road building in the Philippines was the 357 kilometers built in 1911. A series of electric bulbs in a space 1 meter long was lit up at the rate of one every twenty-nine seconds, the space illumined by each bulb representing 1 meter of road. This illustrated the rate at which road construction had advanced during each working hour of the entire year. Other exhibits gave the average cost of completed heavily

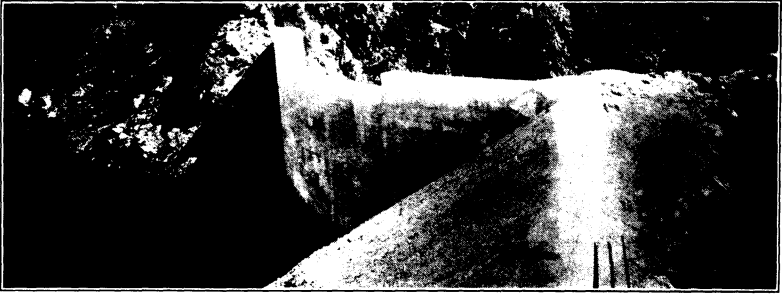
surfaced roads with durable structures as ₱10,200 per kilometer, the average value of traffic, excluding produce consumed locally and produce and shipments rehandled, was ₱139 per kilometer. Still another indicated that an additional 3,000 kilometers of surfaced road were needed in the near future.

These other colored charts showed the expenditure of nearly ₱1,000,000 in the thirty-one provinces simply for up-keep of roads during the year. One of these exhibited the most remarkable public-works development in the recorded history of the Islands, viz: The persistent growth of the isolated "camintero" system of maintenance. This is the system employed on all heavily surfaced roads and consists in stationing one man either every kilometer, or every 2 kilometers, depending upon the season, and making him personally responsible for that short section. Beginning in 1908 with only about 300 kilometers this system grew each month until December, 1911, the length so maintained was nearly five times the original length. When we appreciate the fact that the provinces, unaided by the Insular Government, finance the road maintenance, it is very evident that the Bureau showed results for this feature.

This system of organized camintero maintenance is under the supervision of the district engineers of the Bureau. The system of inspection whereby the maintenance is kept effective consists: First, of a daily tour by the "capataz" over the work of the caminteros on the several kilometers in his charge; second, of a weekly trip by the foreman over the sections under the several capataces; third, a bimonthly inspection by the district engineers; and, fourth, a quarterly inspection by the division engineers. As a result the roads, once completed, show a constant improvement thereafter. The parts of the road system which are not maintained by the isolated camintero system are kept up by gangs.

In 1906 the sound and progressive general policy, for public structures as durable as possible and well maintained, was brought to bear on bridges and culverts. This involved the extensive use of reinforced concrete, of new standards and new designs. The reinforced road structures found in nearly all the provinces to-day are in accord with the best modern engineering practice.

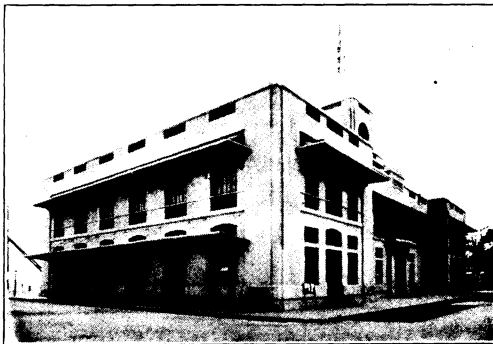
The number of bridges and culverts in the Philippines has doubled during the past four years, and the total length of span has increased 360 per cent. Some 1,332 reinforced-concrete structures have been built. A number of enterprising municipalities have built bridges of one or more arches over waterways



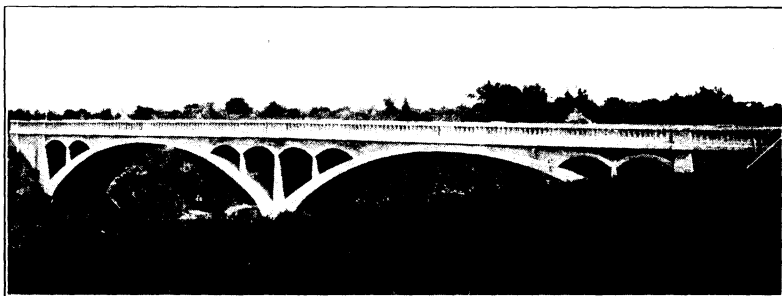
UPPER FACE (SIDE VIEW), STORAGE DAM, OSMEÑA WATERWORKS, CEBU, CEBU.



JULIAN DAM, IMUS ESTATE, 2 KILOMETERS SOUTH FROM IMUS, CAVITE DIVISION.



CUSTOM-HOUSE, CEBU, CEBU.



VAUGHAN BRIDGE, ON SAN PEDRO TUNASAN-CALAMBA ROAD, KILOMETER 25,
LOOKING NORTHEAST, LA LAGUNA.



PLATE III.—BAY-SAN PABLO ROAD, LOOKING WEST—KILOMETER 52, LAGUNA.

of considerable width. The exhibit showed this noteworthy improvement by means of charts, models, and photographs.

In the section devoted to building work appeared wash drawings of the new capitol of the Philippine Islands at Manila by Mr. G. C. Fenhagen, assistant architect, designed under the supervision of Mr. W. E. Parsons, Consulting Architect to the Commission. This was the largest item of proposed work exhibited. The drawings showed exactly how it is expected to utilize Wallace Field in connection with the Luneta improvements. The design for the capitol is noteworthy in that it has assumed nearly final shape without enlisting help outside of the Islands.

The remainder of the building exhibit showed the effect of the general building policy of the Government which is, briefly, to confine new construction to concrete, stone, or a superior grade of native hardwood properly seasoned. A chart in the exhibit showed 158 buildings constructed during the year and a total cash expenditure for all building work of nearly ₱2,600,000. There were large colored photographs of new hospitals, new provincial buildings, schools, and similar public works largely of reinforced concrete throughout. Nearly one-third of the buildings constructed during the year were public schools of one class or another. The Consulting Architect, by means of a force on the Bureau pay roll, prepares all building plans and estimates.

The artesian-well exhibit showed very definitely the large results obtained in the past seven years. Over 500 wells have been driven and these all produced potable water. Two well-rig models were shown. One was that of a deep-well rig with a capacity of 914.40 meters in any kind of ground. The other rig model was of the kind which sinks pipe in soft soil by means of a jet of water. About four-fifths of the total number of wells driven have been successful. They have all been driven in the most thickly populated territory of the provinces. The exhibit also included a model showing strata in their relation to artesian wells.

It is computed that within carrying distance of the 500-odd successful wells there are 1,000,000 people. Large colored photographs showed two of the flowing wells recently completed.

A large relief map showing by actual running water the proposed plan for irrigating the 30,000 hectares between Malolos and Norzagaray in Bulacan Province, was, from the point of view of the visitors, one of the most attractive of the exhibits. The estimate of the cost of this irrigation plant was ₱2,500,000.

For this sum, and without any particular increase in the number of farmers, the production can be greatly increased.

A plan and chart showed the present situation as regards the territory from Bulacan north of Pangasinan. Exclusive of occasional brush-and-stone dam work put in by the farmers themselves, there are now only three small tracts of irrigated land in this territory, totaling 750 hectares in area. There are ten other tracts, with a total area of 250,000 hectares, which are adapted to irrigation by modern and systematic methods. The present rice production of this part of the central valley of Luzon is only four and one-half million cavans¹ of rice yearly, valued about ₱30,000,000. Irrigation would double the production and value of the products and insure against drought.

The area now irrigated in the thirty-one Christian provinces by modern methods is about 50,000 hectares as against 450,000 hectares irrigable.

Other parts of the exhibit showed the Osmeña dam and reservoir recently completed to supply water for the city of Cebu, operation of the Benguet automobile line, and some old Spanish irrigating works and bridges. The colored photographs of the Benguet country were interesting as showing the passage of automobile freight and passenger trains over the road in the latter part of January, 1912.

THE EXHIBIT OF THE BUREAU OF HEALTH.

By DR. G. I. CULLEN, *District Health Officer.*

The Bureau of Health was represented by a sanitary exhibit located in the center of the Insular Building of the Exposition covering an area 10 meters long and 7 meters wide, and an emergency hospital consisting of two large hospital tents located in the Carnival Grounds near gate No. 2.

In the exhibit were displayed a modern bathroom, models of sanitary houses, a municipal water filter, artesian wells, and a sanitary privy; also two relief maps in modeling clay of the barrio of Santa Monica showing its condition before and after reconstruction by the Bureau; a small ice machine; an incubator; rat traps; sanitary bottles and carriers for milk, tuba, etc.; the various kinds of rice; case containing stuffed rats; jars containing flies and mosquitoes, and a small disinfecting pump. In addition, demonstrations of infant feeding were given by a trained nurse.

On the walls were displayed charts showing the birth and

¹One cavan equals 75 liters.

death rate of Manila by years for the past ten years, cycles of the fly and mosquito development, and the diseases transmitted by them, the rat flea, rat guards for vessels, statistics of plague and cholera, deaths from beriberi, tuberculosis prevention, photographs of infants properly and improperly cared for, and of a number of cases of plastic surgery.

The emergency hospital was equipped with cots, regimental and detachment field chests of the U. S. Army Medical Department, white enamel instrument case, washstands, bowls, chairs, and a sterilizer, and during the hours at night when the crowds were greatest an ambulance was stationed there to facilitate the transfer of any serious cases to the General Hospital.

The plumbing display consisted of a modern tiled bathroom with enamel metal siding, bathtub, shower bath with curtain, frame and base to catch the water, low-tank flush water-closet, with white enamel metal seat, washstand and foot bath, together with traps, drains, and other fittings for sinks and drains.

The sanitary houses were models constructed by the division of sanitary engineering and demonstrated the unit idea to be followed in tenement-house construction, each house being separated from the adjoining one by a party wall and having its own kitchen, water supply, water-closet, and drainage, with galvanized-iron roofs and gutters, and free through ventilation from front to back of house; this was secured by large double opposing windows in front and back walls, as well as large openings in all cross-sections of rooms to facilitate the free passage of air through all parts of the house. Each unit has its own back yard entirely fenced in by a closed type of fence, while the part devoted to the kitchen, etc., is separate from the house and connected with it by a short covered or uncovered passageway. Where upper and lower floors are occupied by separate families, each floor is a complete unit, the upper one having its own stairway leading to the street; the lower floor, excepting the passageway, is raised about 1 meter from the street level, the most striking feature being the unusually large window and door openings in both the front and back of the house. The model of the nipa house constructed especially for tuberculous persons gives a much larger comparative area of window space than is customary, and the front and back of the house are provided with large covered porches connected with the house by doors and intended for use as sleeping quarters, they being located on opposite sides and near the corners of the house to afford shelter in inclement weather.

The municipal water filter consists of a large rectangular-

shaped cement tank divided across by a wall, thus making two spaces, one about five times the size of the other. Into the smaller space, which serves as a settling bed or basin, the water enters and the overflow passes through pipes into the larger and filtering tank, this being filled with filtering mixture composed of sand and gravel; after passing through this the water leaves the tank at the opposite end and is ready for use. This filter is also divided lengthwise by a concrete wall which permits of cleaning one half while the other half is in service. The settling basin is also provided with large valves to facilitate cleaning.

The model of an artesian well consisted of a vertical section of soil from the surface down through several strata of rock, gravel, and sand, the upper or clay strata representing the polluted part, next coming the rock strata which act as a barrier against contamination of the lower sections, from which the water is obtained. A small glass pipe representing the driven well extended from the surface down to the gravel strata; through this a stream of water was kept flowing by syphonage. The perspective being a hillside, this illustrated how contamination of surface water occurs by natural drainage at a distance and at lower levels from habitations.

The sanitary privy is constructed with the object in view of (1), securing a receptacle for the excreta; (2) privacy; and (3) protection from fly infection and soil pollution. The requirements being: That the excreta must not be deposited on the ground nor animals, flies, or insects, have access to it; that its sanitary condition and the protection offered in bad weather will make it a place to be sought rather than shunned when responding to the calls of nature. The house shown in the model is square with a slanting roof and narrow screened ventilating spaces at the top, floored, door in front with coil spring, seat along the back wall with cover opening, and a small door in the back opening from the level of the seat to the ground for the purpose of removing the bucket or other receptacle of excreta for cleaning. The cover of the seat should be hinged and so hung that it will close of its own weight when the occupant rises, this to prevent flies from having access to the excreta and eliminating the element of forgetfulness on the part of the person using the closet. There should also be a small box inside to be kept filled with dry earth, wood ashes, or lime, together with some implement by which a small amount may be thrown on each stool. When one considers that dysentery, diarrhea, typhoid fever, cholera, hookworm disease, tuberculosis, Cochin China diarrhea, eelworm infection, and several other of the

commoner diseases as well as some of the rarer ones in human beings are spread largely through fly infection and soil pollution, the importance of a sanitary privy will be better appreciated.

The relief maps of Santa Monica presented very forcibly the former condition of this as well as that of many barrios with their irregular location of houses, no provision for the disposal of excreta, no drainage—with the resulting swampy and filthy condition of the lower sections—no market, and a sluggish estero serving no other purpose than the collection of filth. The model barrio showed a regular arrangement of streets and alleys with corresponding regularity and uniformity in house location, a sanitary market, midden sheds or dry-earth closets systematically and conveniently distributed, each street and alley provided with a drain on both sides into which every house is required to drain, a cement base being placed under the kitchen or back part of the house to collect the waste water and carry it directly to the street drain thus avoiding the formation of stagnant water on the premises, the street drains emptying into deep drains which communicate directly into the esteros which in turn are washed daily with tide water; when practicable, fireplugs are also used to flush out these drains. Public hydrants also are located on the side of the street where their waste water is conducted directly into the drain on a cement base.

The ice machine shown is of French make and occupies a space but $1\frac{1}{2}$ meters long, 40 centimeters wide, and 1 meter high. It is intended for house use and its purpose in the Bureau is the preservation of vaccine virus at remote places in the provinces where vaccinating is being done and where ice or cold storage is not available. It is a vacuum machine, the necessary lowering of the temperature being obtained by means of the extraction of heat and moisture by the use of sulphuric acid and an air pump.

The rat traps shown and adopted are of two kinds, one a cage constructed of bronzed wire with entrance at one end and trap door in center partition and capable of holding a number of rats, the other, the wooden variety with a strong spring which upon being released by the rat touching the bait strikes the rat on the back of neck, killing and holding it. The sanitary bottles for milk, etc., are liter bottles having stoppers and carried in cheap wicker carriers in groups of four, thus preventing contamination of the contents by dust and insects and avoiding frequent handling in carrying.

The various grades of rice, both polished and unpolished (or milled and unmilled), were shown in bottles, together with the

rice pericarp, and demonstrations were given in which the polished rice was shown to be the cause of beriberi, as proven by the results of an unpolished rice diet at the leper colony at Culion, in jails, lighthouse stations, Government vessels and institutions, and among native troops of the United States Army, as reported by Dr. Heiser to the meeting of the Philippine Islands Medical Association, February 23, 1911, and the reports of the investigations of Aron, Hight, Frazer, Stanton, Kilbourne, and De-Haan. The presence of 4 per cent or more of phosphorus pentoxide is considered sufficient to class the rice as unpolished and acceptable.

The importance of this as a sanitary question is emphasized by the fact that in Manila alone during the year 1911 there occurred 1,500 deaths from beriberi which could have been prevented by the substitution of unpolished for polished rice.

The case of stuffed rats contained specimens of the *Mus rattus*, or black rat, *Mus norvegicus*, or wharf or sewer rat, and the *Mus musculus*, or house mouse, all found in the houses of Manila and capable of carrying plague, if exposed to the infection.

In specimen jars, and undergoing development, were displayed the larvæ and adult *Stegomyia persistans*, or day mosquito; *Culex fatigans*, or night mosquito; and the common house fly.

The small disinfecting pump exhibited is used to spray rooms with a disinfectant solution from a bucket. This pump is small, simple, cheap and effective, and, in addition to the purpose designated, it may also serve as a small fire extinguisher, sprinkler, and spray pump for the application of whitewash.

The history of cholera and bubonic plague was shown by charts as follows:

Cholera.

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911
Cases	4,664	910	8	226	848	223	1,186	284	310	1
Deaths	3,560	810	7	225	744	194	819	227	224	1

Plague.

	1899	1900	1901	1902	1903	1904	1905	1906 ^a
Cases	1	271	485	10	198	84	45	7
Deaths	1	199	427	10	174	78	43	7

^a None since.

The cycles of the development of the fly and the mosquito were well illustrated and represented their natural surroundings,

while the necessary means for their extermination were given as follows:

FLIES.

1. As flies breed in manure and garbage therefore bury or burn all such material.
2. Screen all food.

MOSQUITOES.

1. Bury all old empty bottles, tins, or whatever may serve as water receptacles.
2. Screen cisterns, water barrels, also manholes, ventilator tubes, and discharge pipes to vaults and sewers.
3. Drain or oil all ponds, pools, and cisterns, 150 cubic centimeters of petroleum being required for every square meter of surface, this to be renewed every one or two weeks.
4. As mosquitoes transmit malaria, filariasis, yellow fever, and dengue, destroy all breeding places and sleep under a mosquito net.

The rat flea (*Pulex cheopis*) was shown in a drawing; this flea is the common rat flea of India as well as of the Philippine Islands and transmits bubonic plague from rat to rat and from rat to man.

Tuberculosis prevention was shown by a series of comparative pictures with text:

One side showing:

1. The open and well-ventilated house with person sleeping on the covered porch.
2. Cigar making in clean room with cigars screened, stationary wash-stand, good ventilation, high work tables and spittoons.
3. Boys and girls playing lawn tennis and exercising in open air.
4. Eating meals on high table, clean, and with knives and forks, food screened from flies, good ventilation.

The other:

1. A closed and poorly ventilated house, person sleeping inside on the floor with dirty clothes and cooking utensils drawing flies.
2. Low tables with girls seated on or near the floor, no spittoons, a small window affording but the poorest ventilation, and no screens.
3. Children playing inside the house on dirty floor, no ventilation, dog eating food scattered on floor and flies abounding.
4. Eating food with fingers on low table, no screening from flies, baby and dog playing together on dirty floor, and stable just outside with direct fly communication to food.

These illustrations were shown for the purpose of teaching:

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| <p>1. Sleeping with the windows open or outside means clean air, pure blood, and good health.</p> <p>2. Work and study in pure air makes mind and body alert.</p> <p>3. Play and exercise in clean open air. Keep out of doors as much as possible.</p> <p>4. Eat clean nourishing food, protected from flies and dust.</p> <p>5. Don't spit in public places. Don't swap gum, apples, etc. Don't put pencils or money in the mouth. Don't eat candy, fruit or pastry that has been exposed to flies or dust. Don't sneeze or cough in another's face, don't let another infect you in this way.</p> | <p>1. Closed windows mean dirty air, and poisoned blood. This means death.</p> <p>2. Dirty dusty hot rooms are killing. Destructive to health and efficiency.</p> <p>3. Indoor play and playing in dusty places is not healthful play. Exercise in dirty air is dangerous.</p> <p>4. Dirty food kills thousands. Flies and dust contaminate food.</p> <p>5. "No spit, no tuberculosis." There is spit on used gum. There is spit on pencils and filth on money. There are all kinds of germs on such.</p> |
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The part of the exhibit that attracted much attention was the demonstrations on infant feeding given by one of the Filipina trained nurses from the General Hospital. The points emphasized were cleanliness and caloric or scientific feeding as now taught and carried out in the General Hospital. The demonstration showed first, the washing of the feeding bottles with clean cold water, then with hot water and soap, followed by placing in a clean pan and covering with clean cold water and boiling for twenty minutes. During this interval the nipples are to be cleaned by washing with clean cold salt water, then placed in a clean pan, covered with water and boiled ten minutes, then placed in clean cold water and covered with a pan or cloth. The dish pan should be kept for dishes only and the dish towels are to be washed in soap and water, rinsed in cold water and boiled twenty minutes, rinsed twice in cold water and then hung up to dry. Before handling any food for the baby the mother or nurse should carefully wash her hands; after nursing, the breast should be washed 3 times daily with soap and water and then rinsed with hot water. Where there is any tendency to sore mouth in the baby a mouth wash of a solution of boracic acid and honey should be frequently used.

The emergency hospital treated an average of about fifteen cases daily, both medical and surgical. Two cases of fracture,

one spinal injury, one laceration of the palmar arch of the hand, one laceration and separation of the tendons and muscles of the heel, and two gunshot wounds comprised the most serious injuries. A number of incised, lacerated, and contused wounds, as well as one case of a sting by a poisonous fish, were also attended. Among the medical cases there were malaria, dengue, parotitis, acute indigestion, ptomaine poisoning, epilepsy, syncope, and conjunctivitis from confetti lodging in the eye.

The Bureau was represented by Dr. G. I. Cullen with medical inspectors Zach Laughlin and C. E. Norris on duty at the hospital, while two American and five Filipino sanitary inspectors were also detailed.

THE EXHIBIT OF THE BUREAU OF FORESTRY.

By E. E. SCHNEIDER, *Wood Expert, Bureau of Forestry.*

The Forestry Exhibit at the First Philippine Exposition was not only larger than the exhibits at the Carnivals of the two preceding years, but in some respects was also more varied than these. Especially was this true in the case of the articles of furniture shown.

The main feature of the exhibit was, as usual, the collection of planks from the Museum of the Bureau of Forestry. These planks, ranging from less than 3 decimeters to nearly 1.22 meters in width, entirely covered the walls of the exhibit with the exception of narrow panels of green at regular intervals. On these panels were displayed maps and statistical tables interspersed with trophies of the chase and ornamental articles such as woven hats manufactured from minor products. More than seventy species of timber are represented by the one hundred and thirty-odd planks of the collection.

To many visitors the logs arranged at intervals about the walls and piled in massive pyramids about the bases of the pillars were of equal or even greater interest than the planks, as they show not only the longitudinal section, but also the cross-section of the wood, besides demonstrating the relative amount of heart and sapwood, the character of the bark, and the shape of the tree. This exhibit of logs included practically all the woods of the classified list in the Forest Manual, besides a large number of others, the total number of species shown being about 125. Excluding those duplicated between the logs and the planks, the whole number of species exhibited reached over 150.

The furniture exhibit included a number of antique specimens. One of the most interesting was a wardrobe of camagon made in Baliuag in 1811 and presented to Governor-General Rafael María de Aguilar. A round sewing table of camagon and a sideboard

made of a rather rare wood, malatapai, both dating from the first half of the past century, were also much admired. The most comment, however, was caused by the two huge one-piece table tops of lauan and dao, 2.92 and 3.10 meters in diameter, respectively. The dao table, which is the largest known in Manila, is a recent acquisition, the buttress slab from which it was made having been donated to the Forestry Bureau by Señor Jaime Serra, a Spanish resident of Masbate. Beside these tables and other pieces of furniture belonging to the Bureau of Forestry, there were exhibited a number of narra tables and other articles of furniture loaned by private parties and by merchants or manufacturers.

Of the exhibits of minor products, the most conspicuous were those of almaciga, or copal resin, and gutta-percha, the latter being shown in the various shapes—such as rolls, balls, and bricks—in which it is brought to the markets. Others shown were cabo-negro fiber, rattan (bejuco), bamboo, diliman, as well as small manufactured articles such as liquid measures, baskets, and trays made of rattan and bamboo.

Aside from the color effect of the articles exhibited, the whole scheme of decoration was in green. Beside the panels and borders of dark green bunting surrounding the planks, there were two or three score of living palms scattered about the whole area, while the walls and rafters above the planks, and the railings surrounding the exhibit, were profusely decorated with the long graceful fronds of the nipa palm. An abundance of chairs and benches were strewn about, so that the exhibit was a favorite place for foot-weary visitors to rest at once their limbs and their eyes.

The committee on awards of prizes to Insular exhibits gave the second prize, a silver cup, to the Forestry Exhibit.

THE EXHIBIT OF THE BUREAU OF PRINTING.

By BENJ. P. LUKENS,

Acting Statistician, Bureau of Agriculture.

On entering the Exposition grounds from the Luneta, one's attention was immediately drawn to a small square building whose front bore an imposing electric sign reading "Bureau of Printing." The building was so arranged with overhanging roof and open sides that visitors could walk around the pavilion and see all the displays without exposing themselves to the sun or rain and without disturbing the employees who were operating the various machines and printing devices. In addition to these employees there were always several of the Bureau's foremen

within the inclosure who explained the work that was being done and answered any questions that were asked.

The object of the exhibit was to reproduce in miniature an up-to-date printing establishment and to show by comparison the rapid strides that the art of printing has made in the last twenty or thirty years. As far as practicable the old and new methods were exhibited side by side so that the speed and efficiency of the modern appliances were self-evident to the most casual observer.

Every division of the Bureau was represented and most of the work performed was in execution of work orders being filled for various branches of the Insular Government. The labor was identical with what is ordinarily performed within the inclosure of the Bureau's printing plant and was instructive to all classes of spectators whether they were or were not technically informed as to the details. The operators of the machines and the other workmen engaged in the different processes were all young Filipino men who entered the Bureau several years ago as apprentices and have gradually been elevated to their present positions.

The power for the operation of the machines was produced by a small dynamo driven by an alternating-current motor generating about 5 horsepower. Each machine was driven by a direct motor receiving its electric current from the dynamo. This part of the exhibit was in charge of the young men from the power-plant division.

The composing division had a couple of men "setting type" by hand from the old-style "cases" and at their back was a young Filipino operating a "linotype." To those not familiar with this machine it may be well to make a brief description of it. The operator sits in front of a keyboard somewhat similar to a typewriter. By pressing the keys he releases the individual matrices, or letter molds, and they slide down long grooves into their proper position in the line which is being "set up." When the line is completed, molten type-metal is run into the matrices and a line or "slug" is cast containing all the letters which were struck on the keyboard. The original matrices are then lifted to the top of the machine and moved along the top of the type grooves until each letter drops into its own place and is again ready for use. The lines of type are arranged in columns at the side of the operator and are then ready for the taking of a "proof." By this machine the type is "set up" many times faster than by the old hand method and no time is lost in "distributing" or returning the types to their boxes.

Two printing presses were shown by the press division. The "Gordon" platen press was fed by hand and could make 1,000 impressions an hour. The "Harris" press was rotary and had an automatic feeding appliance; it made impressions at the rate of 10,000 an hour. The two machines were printing official envelopes and the work of the "Harris" press was so rapid that it kept one man busy merely to stack up the envelopes in piles preparatory to their being counted.

An interesting feature of the photo-engraving section was an exhibit showing how, by first printing an outline in yellow, then printing over it in red, then following that by an impression in blue, and then finishing in black, a picture was produced showing the delicate shading that usually requires the hand work of a practiced artist. In this section were also displayed some excellent half tones in black and white showing views taken in different parts of the Philippines. Some of the employees of this division were working on the plates of this class of work, cutting away the surplus metal and bringing into clear relief the fine lines which would receive the printer's ink.

The foundry division had men demonstrating the process of electrotyping. Impressions of the type were taken in wax. This wax was then treated with graphite, placed in a solution of copper, and by the process of electrolysis a copper shell was formed, reproducing all the lines of the original type. This shell was then backed with type metal and trimmed and leveled into suitable shape for mounting on wood.

The process of sewing the leaves together to form books was shown by the bindery division. Several young men were seated around a table sewing by the old hand method. In front of them was one of the latest machines for doing the same work. It seemed almost human in its reaching out for the leaves, doubling them, piercing them with binding thread, and placing them in proper position in the volume being bound. The speed, accuracy, and cheapness of the operation of the machine in comparison to the hand method was notable. The bindery had several employees assembling large account books and showing the process of finishing and lettering these huge volumes. In this section were exhibited several volumes whose edges were artistically decorated in gold leaf which was worked by hand into designs representing portraits and scenes executed in minute detail.

The section of the printing exhibit which seemed to attract most attention was that part of the bindery work devoted to marbling. Doubtless many who watched this interesting process had often wondered how the edges and inside covers of books were printed with such curious designs of spots and curves of gaudy

colors. The process seemed simple enough, although it was evident that great care, skill, and practice were necessary to avoid blotting or blistering the sheets that were being colored. A small trough was partially filled with a viscous solution which served as a body upon which to spread the colors; the different colors were dropped on this surface in spots very generally distributed; the colors were then pulled into long streaks or lines by means of a metal comb; then with a small wire the workman moved the colors into circles, waves, or spots to suit his fancy. When the design was finished he laid a sheet of paper carefully on the part to be printed and with equal care removed it showing a reverse reproduction of the colors as they lay. By means of a metal scraper the colors were then dragged off the solution and it was again ready for a new design to be worked on it. There was always a crowd of interested spectators at the side of this marbling trough and as no two designs in marbling are exactly alike, they were given a constant variety of entertainment.

On suitable shelves the Bureau exhibited books showing the different styles of binding from the cheapest to the most costly. Conspicuous in this group was the special material which the Bureau has recently introduced. This material is the result of about eight years of experimenting and has proved to be immune to the attacks of cockroaches. It has almost revolutionized the trade as far as cloth binding is concerned and came near to putting some dealers out of business. Letters of inquiry are continually coming to the Bureau requesting further details of its composition and service, and printing journals state that it is rapidly being adopted as a standard binding.

In summing up the Bureau's exhibit, attention must be called to the skill and efficiency of the young Filipino employees. Most of these men have learned the printer's trade entirely within the walls of the Bureau's plant. They show the result of a carefully prepared system of instruction which is being maintained by the Bureau in all its divisions. In fact, the Bureau is placed under the jurisdiction of the Secretary of Public Instruction largely because of this educational feature. The idea of instruction is never lost sight of and the employees are being constantly improved in their individual work. Many of them have been able to leave the Bureau and obtain lucrative positions in commercial printing houses. While remembering that the Bureau of Printing has an international reputation for equipment and quality of work, let us not forget that it is one of the most practical educational institutions in the Philippines.

THE EXHIBIT OF THE BUREAU OF EDUCATION.

GENERAL EXHIBIT.

By LUTHER PARKER, *Bureau of Education.*

The scope of the exhibit of the Bureau of Education at the Exposition of 1912 was as comprehensive as the general public-school system. In fact, the original plans for this exhibit called for a representation display of the best industrial work from each school in these Islands having three or more grades.

Approximately 16,000 exhibit tags were shipped out to the several school divisions for distribution among their schools, and nearly all of the tags were used on articles of value made by the pupils of the schools during the past year.

A series of preliminary local exhibits, held in the town and provincial centers before the Insular show, was a factor in the selection of the articles to be sent on to the Exposition. In many provinces these local exhibits were the means of arousing a great deal of enthusiasm among the patrons of the schools and interesting them in the industrial work of the pupils. Reports received by the Bureau of Education from provinces where this idea was fully carried out were very satisfactory and encouraging. They demonstrate at once the real value of interesting the public in that phase of school work that has for its aim the fitting of a people for economic independence through the practical scientific training of the child to advantageously apply himself to the production of useful and salable articles.

It is conceded that the Philippines are essentially an agricultural country, and there is here, as in all agricultural communities, an abundance of spare time that can be used to advantage in the handicrafts. The Filipinos are a people eminently painstaking, and they are capable, under proper direction, of quite sustained effort in the making of articles requiring patience and care in their production.

Given such conditions, and the urgent necessity for increasing the per capita production of wealth, the schools find presented a problem that is new in the educational world and well worthy of the best consideration by educators in the United States as well as in the Philippines. Not only is the subject of interest to educators, but to students of economics and statesmen as well; the results of such teaching as is being given by the schools of the Philippines at the present time will be so far-reaching in their effects as to merit the closest consideration of those interested in the future of the Philippines, economically and politically.

The character of the exhibit gives promise of a distribution of work during the next year far wider and better than had even been anticipated. Several provinces in which special effort has been made along definite lines have set standards that will be of great value to the Bureau of Education in its effort to standardize the work generally.

The provinces most worthy of mention in this connection were Albay with its exhibit of Irish crochet work and basketry, and Sorsogon with its basketry exhibit.

The various trade and manual-training schools presented exhibits which indicate a very gratifying progress. Especially notable were the exhibits from the trade schools of Manila, Sorsogon, Pangasinan, Iloilo, and Pampanga, all of which had first-class articles that received the unqualified approval of the public. This fact was demonstrated by the sale of practically everything offered from the above-named schools.

The improvement in the character of the work in general over that submitted last year, and the practical approval by the public as shown by the sales returns, have demonstrated beyond question that with proper attention by the directing, superintending, and supervising forces of the Bureau of Education in the development and perfection of new lines of industry, the Philippine Islands will be enabled in a very few years to export handwork of a high grade and in large quantities. This will be brought about by the training of boys and girls in the higher grades of the public schools to specialize along those lines of industrial work that will utilize the wealth of raw materials with which the Islands have been so bountifully provided.

It is evident from the exhibition just past that in their handwork the girls and women of the Philippines can vie with the women of any country, and the imagination fails to grasp the possibilities of production and export, under favorable tariff conditions with the United States, of the fine laces and embroideries which can be turned out in a few years when the school girls of the present have homes of their own and use their spare time in the production of fine work learned in the schools.

The value of all the articles sent to the Exposition from the various provinces amounted in round numbers to ₱26,000, of which over ₱18,000 worth were sold, the balance being returned to the respective provinces. In addition to the values mentioned above, the Philippine Normal School, the Philippine School of Arts and Trades, and the schools of the city of Manila sold articles to the value of an additional ₱8,000, making the grand total of sales over ₱26,000. A large part of this amount goes

directly to the pupils who accomplished the work; in cases where the pupil furnished the material himself, he collects the total amount received for the article sold.

A system of accounting has been devised, with the approval of the Insular Auditor, by which the money received from sales at the Exposition is returned to the owners and receipts are taken therefor; this arrangement provides a satisfactory system of accounting.

It is the intention of the Bureau of Education to extend the industrial work during the coming school year to every school in the Philippine Islands under its jurisdiction. By means of a carefully graded course of industrial work, which is now being outlined by committees of the teachers best qualified for the work, it is the purpose to introduce into the homes of the townspeople such industries as are fitted to the localities in which they live and which are adjudged to be of most value economically to the particular sections.

In all this extension of school industrial work, however, the vital fact that the psychological and moral development of the child is paramount is kept constantly in mind, and the course of study in industrial work is so planned that while its execution will better fit the child for handwork by which he can make his living, the child's development is still placed before the development of those special industries which follow as a natural result of the steps taken in carrying out the course.

VEGETABLE AND FARM EXHIBIT OF THE BUREAU OF EDUCATION.

By NORTH H. FOREMAN,

Inspector of School Gardens and Sites.

A complete review of the vegetable and farm exhibit of the Bureau of Education at the First Philippine Exposition held in Manila, February 3 to 10, 1912, is not being attempted in this paper, several of its most prominent features only being noted. The exhibit was composed entirely of garden and farm products raised by school children, mostly in the primary grades. There was no attempt to make a complete exhibit of Philippine products. The sole object was to interest the visiting teachers, pupils, and general public in the agricultural activity of the schools.

The exhibit was composed of contributions from gardens in the Provinces of Union, Albay, Pampanga, Batangas, Pangasinan, Bulacan, Tarlac, Bataan, Nueva Ecija, Tayabas, Camarines, Capiz, Rizal, La Laguna, Zambales, the Philippine Normal School, the Manila city schools, the school farms at Muñoz, Batac, and Indang, and the Tanauan school nursery. The fact that



Photo by Bruce Ingersoll, B. of E.

PLATE IV.—A GENERAL VIEW OF THE VEGETABLE EXHIBIT, BUREAU OF EDUCATION.

the exhibit came from sixteen provinces and represented five hundred individual contributors, living in more than eighty different municipalities, will indicate in a measure the scope of the work. It is also interesting to note how rapidly the work is reaching the people. In the Provinces of Albay and Union 74 and 64 per cent, respectively, of the individual contributors furnished vegetables from the home gardens of the pupils.

The details of the different kinds and varieties of vegetables submitted would exceed the object of this article; the leading features only are reviewed herewith.

Classes of products exhibited.—Grouping them roughly, it might be stated that the following products were displayed: Leaf vegetables, 7 kinds; fruiting vegetables, 3 kinds; foreign roots, 7 kinds; native roots, 10 kinds; legumes, 6 kinds; vine crops other than legumes, 8 kinds; grains, 6 kinds; forage, 2 kinds; other farm crops, 4 kinds; fruits, 6 kinds; tree seedlings, 10 kinds.

Prize exhibit.—A Manila merchant, who is interested in the extension of garden work in the Philippines, provided a group of excellent prizes for a vegetable contest, the prizes to be awarded under conditions prescribed by the merchant and by the Director of Education, under seven classes. The excellent quality of the tomatoes, peppers, eggplants, and cabbages exhibited in this contest was a keen surprise, and the source of much favorable comment and admiration from the general public. Mr. O. W. Barrett of the Bureau of Agriculture, Mr. W. F. Montavon of the Bureau of Education, and Mr. A. M. Darley of Manila acted as judges for the contest, and the prizes awarded were distributed widely among the schools of the Philippines.

Corn.—A corn contest, the first ever held in the Philippine Islands, was a part of the exhibition. The twenty competitors represented twelve provinces. It was the beginning of what should be a leading feature of subsequent expositions.

Forage.—Three kinds of forage were sent from the Central Luzon Agricultural School. This exhibit received the special attention of Army officers.

Yams.—The exhibit of yams, or camotes, while it did not attract the attention that such an exhibit should receive, was excellent. This product, which excels the Irish potato in food value, is an example of what can be grown in Philippine gardens.

Nursery.—The Tanauan Intermediate School exhibit of tree seedlings showed what is being done in many schools to further the growing of trees of economic value.

Green peas.—The green peas and young potatoes exhibited

from the Indang farm indicate that the time may not be far distant when the general public can be supplied with these vegetables.

Few persons not familiar with the work of the Bureau of Education have any conception of the extent to which gardening is now becoming the solution of the important problem of more good wholesome food for the people. Recognition of the fact that questions of the seasons and of transportation form no small feature of vegetable exhibits, and that the contributors were school boys, doing work in the main new to their fathers as well as to themselves, makes the showing even more creditable.

To the Bureau of Agriculture is due great credit for its liberality in filling the requests of school pupils for seed; it has played an inconspicuous but very valuable part in the success of this exhibit.

THE BUREAU OF SCIENCE EXHIBIT.

For the previous Carnivals, the Bureau of Science has provided exhibits that were more elaborate than that just displayed at the First Philippine Exposition held in 1912, but none have been rewarded with more public enthusiasm. Unfortunately many of the lines of work of the Bureau of Science will not lend themselves to exhibition purposes, but in spite of this the exhibits were varied, and foremost among them were demonstrations of the industrial operations of mining, fisheries, and silk culture.

The culture of silk was of exceptional popular interest. Racks supporting trays of silkworms in all the different stages of their existence, together with baskets of the mature cocoons, formed one part of this exhibit. The different varieties which have been most successfully propagated in the Philippines, namely, the Bengal-Ceylon and Philippine hybrid (Bengal-Japanese) and the Eri castor-plant worms, were shown and arranged on feeding trays so that special attention might be called to each of them. Fortunately it was also possible to show the emerging of moths from the cocoons and the subsequent deposition of eggs. Other portions of this exhibit had to do with all phases of spinning, and the reeling of silk on a hand reel such as is used by the Japanese in their home silk industry. Three Filipino women were the demonstrators in this work. Two others demonstrated the Philippine method of reeling silk on bamboo spools for use in weaving. A loom was on the ground and set up ready for use, but unfortunately the time was so short that it was not possible to reach this state of the industry.

More than a century ago mulberry bushes (*Morus alba* Linn.)

and silkworm eggs were imported into the Philippines, but for lack of financial backing no successful industry was established. Friends and employees of the Bureau of Science imported eggs a few years ago from Japan as well as Ceylon. These were hatched and the worms grown at the Bureau of Science but they produced silk inferior in both quality and quantity. A hybrid between the Japanese and Ceylon varieties was produced which has proved to be very satisfactory, as it produces from eight to nine generations annually. Other countries usually can not produce more than two generations yearly, therefore the Philippine hybrid affords an excellent and profitable prospect for sericulture in these Islands.

The geological, mining, and metallurgical work of the Bureau was shown to a very great advantage. For the first time all the geological maps of the Archipelago were brought together in one large relief map showing the mountains, plains, and all the major features of Philippine geology. This map represents the accumulated data of over thirty years' work, the major portion of which has been performed within the past ten years by the division of mines, Bureau of Science, of the Government of the Philippine Islands.

There were exhibited separate relief models showing the physiographic features of the various better known mining districts. Gold bars showing graphically the production of the dredges of the Paracale district and of the mill of the Colorado mine attracted considerable attention.

A model showing the method of underground working in gold mines was exhibited as a supplement to that exhibited at the previous Carnival which showed the method by which gold is extracted. Another very instructive model was that of a coal mine showing the various stages of development and illustrating the manner of mining coal.

A representative collection of Philippine rocks and minerals were displayed, above which were hung charts showing their economic distribution. In the Philippines there are large deposits of placer gold which have been worked for years and in addition hundreds of square kilometers of promising ground which will some day be exploited. At present two dredges are operating in the Archipelago, two are being built, and three more have been ordered. Gold-quartz veins are also very abundant and have been worked for hundreds of years in a small way. One mill recently started is producing gold worth about ₱2,000 per day.

Large deposits of iron, copper, manganese, and coal can be

found in many localities. Some of these have been successfully worked only on a small scale though they present very extensive possibilities.

A very interesting display was that of the outfits used for catching big game fishes. These outfits displayed in a glass case consisted of rods, lines, hooks, spoons, land nets, gaffs, etc. As a graphical suggestion of the sport to be had in big game fishing in Philippine waters, four large fish, caught during the past year on exploration trips to waters south of Manila, were mounted for exhibition. The varieties shown were a Spanish mackerel, weight 30 kilograms, caught near the coast of Leyte; a jewfish or sea bass, weight 60 kilograms, caught at Meander Reef; an ocean bonito, weight 21 kilograms, caught at Apo Reef; and one giant pompano, weight 22 kilograms, caught off the coast of Palawan. Sea game fishing in the Philippines offers unlimited possibilities both from the standpoint of sport and that of commercial exploitation. Very favorable comment was elicited by the display of exceedingly beautifully executed colored drawings of Philippine fishes.

A very interesting and instructive exhibit was that of the products of oranges and coconuts. Generous samples of coconut oil, both crude and refined, and of soap manufactured from the same were valuable in showing the great possibilities of this industry. Samples of both sun-dried and kiln-dried copra were included in this exhibit. Fourteen bottles of orange juice produced from 100 oranges, orange peel, and paper manufactured from orange pulp were of special interest and suggest new Philippine industries.

Specimens of sand-lime brick in two sizes manufactured from Philippine materials were also displayed. These bricks, owing to the method of manufacture and hardening, are not in any sense ordinary mortar bricks although they are made of a mixture of siliceous material and hydrated lime. Properly manufactured sand-lime brick withstand exceedingly severe tests. When heated to a high heat and suddenly plunged into cold water they undergo no change. They promise to be a very satisfactory building material for the Philippines as there is no doubt of their strength and durability. They would suffice for a structure very much higher than is ordinarily built in the Archipelago.

There was included in the Bureau of Science exhibit a liberal display of the various publications of the Bureau of Science which gave the public an opportunity of which they eagerly availed themselves to become familiar with some of the very interesting printed matter published by the Bureau.

THE EXHIBIT OF THE BUREAU OF INTERNAL REVENUE.

By F. C. KINGMAN, *Agricultural Inspector.*

Due to the efforts of the Bureau of Internal Revenue, and to the cordial coöperation accorded that office by its internal-revenue agents and by the provincial and municipal treasurers, the consumption of denatured alcohol in the Philippine Islands within the past year has nearly doubled. From a consumption of 275,000 gauge liters in the year 1910, there has been an increase to 525,000 gauge liters during the year just closed, 1911. It is the sincere desire of the Bureau that it may have the same support and coöperation, in the introduction of this comparatively new commodity, in the future, as has been given during the past year. The uses of denatured alcohol are many and varied, and actual practice has shown that the feasibility of using it as an illuminating fuel is entirely satisfactory, both from the standpoint of efficiency and economy. The experience of the municipality of Boac, Marinduque, bears out the above statement. This municipality has had in operation since December 8, 1911, 6 "Saekular" 150-candlepower alcohol street lamps, which were purchased from G. Martin, Manila, for ₱75 each. These lamps have given entire satisfaction, and aside from giving a much better light than the higher power lamps installed in Lucena, Tayabas, they have, up to date, February 29, 1912, been operated without breakage. Various officials of Lucena have inspected the lamps in Boac, and a movement is now on foot to install such lamps in the former town. The foregoing instance goes to show the popularity of the alcohol lamp, when once its merits are made known.

Credit for the installation of these lamps is due the Manila office, and the municipal treasurer of Boac as well in bringing to the attention of the municipal council the various circulars issued by the Bureau on this subject.

The exhibit of the Bureau at the First Philippine Exposition, in charge of Internal Revenue Agent D. C. Fisher, gave a practical demonstration of the various uses to which denatured alcohol may be put. Different-powered lamps, suitable for lighting large interiors, or for lighting streets, parks, or plazas, various classes of cooking stoves, alcohol gas stoves, chafing dishes and accessories, coffee percolators, tea-balls, tea pots and urns, table kettles, small alcohol burners, suitable for heating water and making coffee or toast, were all on exhibition, and were actually demonstrating what they could do.

For the use of the above-named utensils the Bureau is indebted to the following-named Manila firms, viz: Milton E.

Springer Co.; H. E. Heacock & Co.; Wright Furniture Co.; Bazaar Siglo XX; Wm. H. Anderson & Co.; El Plenilunic, and G. Martin.

The denatured alcohol necessary for demonstrating the various lamps and burners was kindly donated by the following-named Manila manufacturers: Ayala & Co.; Compañía General de Tabacos de Filipinas; Tuason, Legarda & Co.; Destileria Lim Tauco; Lo Seng & Co.

Various tests of alcohol lamps and stoves, giving the amount of fuel consumed per hour and cost of same, have been made by the Bureau, and the following data give the results obtained:

LAMPS TESTED SINCE LAST MARCH.

Alcohol used: Denatured by Formula No. 1, 94 per cent, or 188 proof; cost, ₱3 for 15-liter demijohn, or 20 centavos per liter.

1. Hawkins "Sinumbra," 100-candlepower street lamp, consumes 1 liter of fuel in $13\frac{1}{2}$ hours; cost per hour, 1.4 centavos.
2. "Saekular" 300-candlepower street lamp, consumes 1 liter of fuel in $4\frac{1}{2}$ hours; cost per hour, 4.6 centavos.
3. "Saekular" 150-candlepower street lamp, consumes 1 liter of fuel in $7\frac{1}{2}$ hours; cost per hour, 2.6 centavos.
4. "Clara" 100-candlepower street lamp, consumes 1 liter of fuel in $18\frac{3}{4}$ hours; cost per hour, 1.07 centavos.
5. "Clara" 2-burner 200-candlepower street lamp, consumes 1 liter of fuel in $8\frac{3}{4}$ hours; cost per hour, 2.3 centavos.
6. Milton E. Springer Co., 100-candlepower street lamp, consumes 1 liter of fuel in 14 hours; cost per hour, 1.4 centavos.
7. Various house lamps were tested, candlepower ranging from 60 to 100, cost varying from three-fourths to $1\frac{1}{2}$ centavos per hour.

STOVES TESTED SINCE LAST MARCH.

Fuel used: Denatured alcohol by Formula No. 1, 90 per cent, or 180 proof; cost, ₱2.50 per 15-liter demijohn, or $16\frac{2}{3}$ centavos per liter.

1. Universal alcohol stove, consumes 1 liter per burner in 3.6 hours; cost per burner per hour, 4.6 centavos.
2. Pyro alcohol stove, consumes 1 liter per burner in $3\frac{5}{12}$ hours; cost per burner per hour, 4.8 centavos.

The Bureau has also made tests comparing the relative efficiency of alcohol and gasoline for power purposes, the results of which have been published in Bureau of Internal Revenue Circular Letter No. 373. A copy will be furnished by the Bureau, upon application.

Those desiring further information regarding the uses of denatured alcohol should communicate with William T. Nolting, Collector of Internal Revenue, Manila, P. I.

THE BUREAU OF AGRICULTURE EXHIBIT.

THE AGRICULTURAL-HORTICULTURAL EXHIBIT.

By SAM. H. SHERARD, B. SC., *Agricultural Inspector.*

Situated at the lower end of the provincial exhibits and near the machinery building, surrounded by alternate rows of large and small *bunga* palms, interspersed with shrubbery, the agricultural and horticultural products of the Islands were very effectively displayed in a *sawale* building 45 meters long by 20 meters wide.

Running the entire length of the exhibit were double rows of posts and large *bunga* palms which divided the building into eighteen sections, each 5 meters wide and 3 meters deep, and containing a complete display of some one agricultural product.

Near the main entrance was an ornamental bed of palms and smaller plants with a background of long asparagus ferns and white orchids in pots.

There were six booths down the center aisle of the building, each 1.82 meters square, and 2.43 meters high, placed opposite the sections on the side, and each representing one of the staple crops found in the Philippines.

In the center of the building, near the side entrance, was a fountain 3 meters in diameter, surrounded by maidenhair ferns and filled with lotus flowers exhibited by the Luzon Floral Co.

The sections opposite the fountain were banked with ornamental plants and orchids.

The first section on the right of the main entrance to the building contained a collection of photographs of breeding animals belonging to the Bureau of Agriculture, including native, Arabian, American, and mestizo stallions, together with illustrations of types of carabaos and cattle; a rinderpest map with a chart hung from the wall and illustrated by the use of small black and white pins where rinderpest existed a year ago, and where it exists to-day. This map showed that on July 1, 1911, there were 81 towns known to be infected with rinderpest, while on February 1, 1912, there were only 28 towns known to be infected with the disease, a gain of 53 towns. In this section there was also a collection of Bureau of Agriculture bulletins and pamphlets, sets of the AGRICULTURAL REVIEW and bulletins and Yearbooks from the United States Department of Agriculture, all for free distribution. A chart representing the organization of the Bureau of Agriculture was also shown in this section.

Opposite this section, the College of Agriculture displayed

fruits, vegetables, silk cocoons, a herbarium of local economic plants, and charts showing the lines of work in which the college is interested.

FIBER.

The sections adjoining the displays just described were filled with fibers and products made therefrom. In the center of the building opposite the fiber sections was the abacá booth, which was covered with fine grades of this fiber from the Wilson Plantation Company. Here were shown specimens worth ₱24 per picul and grading 200 per cent over good current; also samples from Indang, Cavite, showing knotted fiber worth ₱32 per picul. A table in the abacá booth contained small bales showing the different commercial grades of Manila hemp, together with samples of cotton, kapok, knotted abacá fiber, and various grades of abacá and piña as prepared for the loom. Philippine silk and eleven samples of Manila hemp rope from the Johnson-Pickett Rope Factory showing oiled, dry, and navy grades were also exhibited.

In the fiber sections were shown sixteen samples of abacá representing the standard grades; samples of maguey, sansevieria; cotton, white, dark brown, and light brown; piña and abacá for textile purposes; maguey and sisal, machine and hand-stripped; banana fiber prepared for weaving in the natural color, and dyed; samples of cabo negro and matting straw were also displayed; textile abacá cloth (pinocpoc, sinamay, and other coarse material used for lining ladies dresses); different grades of knotted fiber and some prepared for the loom; grades of piña, pure and mixed with silk and cotton, showing the different kinds of weave; also samples of fiber prepared for the loom; first, second and third grades of banana cloth; Philippine cotton cloth, showing blankets, towels and fiber in different stages of preparation; two grades of maguey cloth; two belts of bark fiber together with pineapple, maguey, sansevieria, and sun hemp plants growing in tubs.

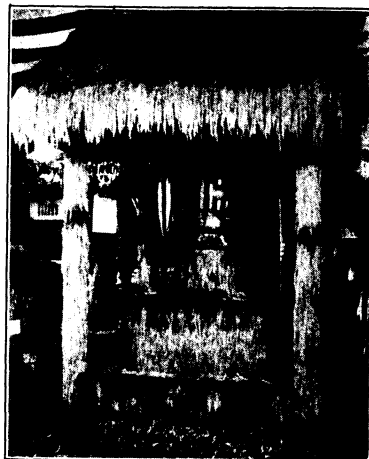
In this section were also found five grades of buri mats, fancy and plain; ticog mats; four grades of Moro mats, Lanao weave; four grades of Bohol weave; four grades of Samar weave, both plain and fancy; sabutan mats, four grades; grades of ordinary pandan; also two grades of buri mats, which are generally used as sail cloth for native boats and are prepared from the epidermal layer of the buri palm. There were also shown nine grades of buntal hats (Lukban), with the fiber in different stages of preparation, and cigar and cigarette holders made of the same material; eight grades of Calasiao hats, a cigar holder, and



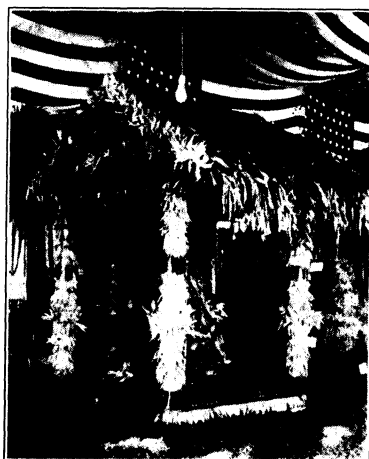
PLATE V.—INTERIOR VIEW, AGRICULTURAL-HORTICULTURAL BUILDING, FIRST PHILIPPINE EXPOSITION.



FIBER BOOTH.



RICE BOOTH.



CORN BOOTH.



COCONUT BOOTH.



SUGAR-CANE BOOTH.

samples of fiber in different stages of preparation; three grades of bejuco (rattan) hats and cigar holders together with fiber in different stages of preparation; fourteen grades of bamboo (Baliuag) hats, a cigar holder, and samples of the fiber for making hats; ten grades of sabutan hats, with fiber; eight grades of buri-leaf hats with fiber; four grades of nito hats with fiber; eight hats made of nito, bamboo, and buri; hat made of ticog grass; two grades of pandan hats together with a collection of instruments used in making hats. This collection of hats and hat-making material is the most complete in the Philippines, and is on exhibition at the main office of the Bureau of Agriculture.

There were also specimens of hand-made rope, and harness made from abacá, cabo negro, buri, etc., together with matting straw made from ticog, pandan, buri, abacá, and sabutan fibers.

A map showing those provinces in which abacá thrives best formed part of the fiber exhibit, and with the chart which gave statistics on abacá exportation, etc., the visitor was able to get valuable data on Manila hemp.

FORAGE.

Section No. 3, on the right, contained a collection of forage samples grown under the encouragement of Colonel J. C. Gresham, near Army posts. In this exhibit were found specimens of the following forage plants: Guinea grass, both green and baled; native hay; Rhodes grass; Sudan grass; Pará grass; Italian rye grass; sorghums; pea-vine hay; peanut hay; corn-blade fodder, and Brazilian grass. The following farmers had samples of forage in this exhibit: Charles Schück, Jolo; Albert F. Keil, Parang, Cotabato; John Logan, Bayambang, Pangasinan; Pablo Tan, Ormoc, Leyte; Colonel Wood, San Pedro Tunasan, La Laguna; G. W. Boswell, Parang, Cotabato; San Ramon Farm, Zamboanga; R. T. West, Malabang, Lanao; W. M. Wheeler, Malabang, Lanao; Leandro Reyes, Biñang, La Laguna; A. B. Clemmer, Parang, Cotabato; José Villanueva, Camp McGrath, Batangas; P. Von Krebs, Camp Downes, Leyte; Martin Cavanaugh, Dolores, Leyte; R. K. Netherlands, Nolsen, Pangasinan, near Camp Gregg; Major L. F. Garrard, Camp Overton, Mindanao; Lieutenant George P. Tyner, Jolo.

The Bureau of Agriculture had a very creditable collection of forage from the Alabang stock farm and the Singalong experiment station: From Alabang, Guinea-grass hay baled, one year old; native hay baled, one year old; Rhodes grass, baled one year; Sudan grass, baled one year, and sorghum; from Singalong,

specimens of growing Guinea grass, Rhodes grass, and Pará grass, together with a shock of extra good Mexican June corn. Señor M. Magno, from Tagig, Rizal, had a good collection of barili grass shown both baled and growing.

CORN.

In the section next to the fiber, on the left side of the building, corn was displayed. Here were exhibited 500 ears of selected native flint, both white and yellow, and Mexican June—a dent corn introduced by the Bureau of Agriculture. These specimen ears were grown at the Singalong experiment station and in the Provinces of Cebu, Iloilo, Bulacan, and La Laguna. Charts giving the yield of corn by provinces, and illustrating the selection of seed corn were displayed, together with a map showing the distribution of corn over the Islands and photographs illustrating the different stages of corn growth. A seed-corn tester and a device illustrating the depth to plant seeds were also shown here with information as to their use; a large ear of corn 1.21 meters in length by 30 and 46 centimeters in diameter, made from native yellow flint corn, was shown. Opposite the corn section in the center aisle, corn was displayed in the shock, unhusked and husked, making a very pretty booth.

RICE.

Next to the forage section on the right and the corn section on the left, rice was shown in the stalk and in the hull. The section adjoining the forage section contained 358 varieties of upland rice grown by the Bureau of Agriculture at the Lamao experiment station. Here was also shown a good specimen of irrigated rice from San Miguel, Tarlac. The threshed rice was shown in small boxes 18 by 15 by 9 centimeters, each box containing one liter of rice. On the walls were cases filled with samples of rice, together with maps, charts, and photographs giving rice data. A card index of each variety, with all available information, was displayed. In the opposite section 409 varieties of lowland rice, also grown by the Bureau of Agriculture, from the Alabang stock farm, were exhibited. There was a liter sample of each variety, displayed in small boxes; a card index giving all available data was in the exhibit. In the center aisle, opposite the two rice sections, was a booth made of "Palay-Iloco" in the sheath and hulled.

Two models of rice mills were displayed—one a water mill and the other run by hand.

ORNAMENTALS.

Next to the rice section, on the right, was a side entrance to the exhibit. Flanking this entrance were potted ornamental plants and immediately in front was the fountain; opposite this was a section filled with beautiful potted plants and orchids.

The ornamental plants were exhibited by William S. Lyon, Agapito Sanchez, Regino Fermin, and the orchids by several private parties; a large collection of tree ferns came from the Lamao experiment station. The Luzon Floral Company exhibited a collection of garden and flower seeds, and specimens of growing pineapples; they also decorated the fountain with lotus flowers and maidenhair ferns.

VEGETABLES.

In the section next to the side entrance on the right the following vegetables were displayed: Two varieties of radishes, peppers, red, green and yellow, batao, tugui, arrowroot, gabe, sincamas, sweet potatoes, both native and American, patola, ubi, tomatoes, celery, pechay, American peas, cabbage, leeks, cigarrillas, string beans, native peas, sitao, ampalaya, two kinds of eggplants, cucumbers, tabungas, three kinds of musk melons, two kinds of water melons, uyo, pumpkins, and squash.

FRUITS.

Adjoining the vegetable section the following fruits were shown: Roselle, guava, two kinds of mangos, two kinds of breadfruit, chico mamey, mabolo, sweet carambola, pomegranite, caso, jakfruit, pineapples, custardapple, chico, edible banana flowers, guanábano, limes, Mandarin limes, lemon, sour oranges, Mandarin oranges, manzanita, macopa, camias, soursop, cabuyao, lemons (poi-poi), calamondin, tizon orange, papayas, pomelos, tamarinds, cacao, and 11 kinds of bananas. Samples of annatto, Liberian coffee, cacao pods, peanuts and ginger, together with a sample of rubber from the La Carlota experiment station, were also on exhibition.

TOBACCO.

Just opposite the vegetable section, in the center aisle, cigars, cigarettes and tobacco were exhibited in a glass case 1.83 meters square and 2.44 meters high. These articles were loaned by the leading tobacco manufacturers in Manila.

In a section to the left of this booth, the different grades of tobacco were shown. Here also several young ladies gave de-

monstrations of cigarette making. A map, table of statistics and photographs showing tobacco in different stages, were also in this section.

COCONUTS.

Coconuts were displayed in a booth next to the tobacco case. Here were shown nuts from La Laguna, Palawan, Mindanao and Cebu. Copra, coconut fiber, oil, and articles made from the shells were exhibited, together with photographs, statistics and a map showing the distribution of the nuts over the Islands.

SUGAR CANE.

Sugar from La Laguna, Pampanga, Cebu, Batangas and Occidental Negros illustrating the different grades and methods of packing were shown. Canes from La Laguna, Pampanga and a collection of 6 varieties from the La Carlota experiment station were exhibited, together with a map, tables of statistics, and photographs.

In the section adjoining the fruit, M. & R. Hermann exhibited apparatus for destroying termites. A termite colony was shown, with the queen, and information concerning eradication was given.

SEEDS.

In the last section on the right, methods illustrating the packing and testing of seeds and an experiment in soils showing drainage and types of soils were shown. Garden and flower seeds were also distributed free in this section.

Demonstrations in budding and grafting were given in the last section on the left. Instruments necessary in horticultural operations were exhibited and specimens of budded citrus were displayed. From 4 o'clock until 9 every afternoon and evening during the Exposition, lectures were given on methods of propagating.

The agricultural-horticultural exhibit won the first prize for Insular exhibits, a silver cup.

STEAM COPRA DRIER OF THE BUREAU OF AGRICULTURE.

By H. T. EDWARDS, *Assistant to the Director of Agriculture.*

With a loss of several million pesos annually, by reason of the crude and unsatisfactory methods used for drying copra in these Islands, the introduction and use of an improved copra drier becomes a question of great economic importance. The original plans for an apparatus to use steam heat were furnished about one year ago by Mr. O. W. Barrett, chief of the division of ex-

periment stations, but the details of construction have been worked out by Mr. Z. K. Miller, machinery expert of the Bureau. Unfortunately Mr. Miller did not have time to make any preliminary tests of the drier at the Pandacan repair shops of the Bureau, but it was decided to exhibit the original apparatus at the Exposition and to try it out there on the grounds instead of delaying its introduction to the public any longer. It is believed to be the first machine of this type. When perfected it may meet the requirements of the Philippine copra industry and thus help to raise the standard of that product in the Orient.

This drier is 5.64 meters long by 91 centimeters wide, 3 meters high at the front and 2.44 meters high at the rear end. Its sides are constructed of angle iron frames for the sections into which are riveted two sheets of plain galvanized iron with 3-millimeter asbestos millboard between. The tracks for the trays are set on an incline of 61 centimeters to 46 centimeters. There are three rows of these trays with a 51-centimeter space between the rows. Each row holds four trays or a total of twelve trays for the drier. The trays, which are 91 centimeters by 1.37 meters, and 1 decimeter deep, are constructed of wire and angle iron with the bottoms made of bamboo slats set 6 millimeters apart. Each tray has a capacity of about 160 nuts. The trays are fitted with trunk rollers and can be easily handled by two laborers. The incline is such that very little effort is required to push the trays when loaded. Each track has an entrance door and a discharge door 91 by 28 centimeters. There are also three doors of the same dimensions on the top of the drier to carry off the moisture while fresh air is admitted at the bottom below the coils. The coils, located at the bottom of the drier, contain 1,219.20 square meters of heating surface, which will maintain an even temperature between 150° and 180° and will dry the copra in fifteen hours.

There are three methods of handling the raw material in connection with this type of drying apparatus:

1. The Birchfield method which obviates the necessity of husking the nuts—that is, the entire nut is chopped in halves by means of a heavy broadax, the halves being immediately placed either in the sun on a concrete or hard earth *patio*, or placed directly in the trays of the drier where after two or three hours the meat may be readily removed and then replaced to complete the drying process, the refuse husk and shell being thrown aside for fuel.

2. The husked nuts are broken in halves and the shells are either set out to dry in the sun so that the meat can be removed

after about one day of good weather, or else put directly into the trays of the drier and treated as by the first method.

3. The meat from whatever process at any stage of dryness is put into the trays without considering the previous operations and kept there until the attendant in charge pronounces the drying complete. With the latter method of procedure the capacity of a drier of this size is estimated to be about 3,000 nuts in twenty-four hours.

It must be remembered that unripe or partially decayed nuts can not be expected to make first-class white copra, though there is a better chance of obtaining a fair article by the use of this type of drier than by the prevalent "tapáhan" method; the faults which are partially concealed by the tapáhan method—that is, by the smoke obscuring the natural color of the material—are brought out clearly in operating artificial driers. Pinkish or brownish pieces of copra can be readily traced to either one or the other of the errors which are so deplorably common in Philippine copra making; that is, *unripe*, or *overripe* kernels.

The principal advantage in the use of the steam drier is that it is practically impossible to burn the material during the drying though, of course, the time required for turning out a copra which will endure storage in the bodega for several months is considerably longer in the case of an apparatus like this than with a hot-air, or rotary oven, type—makers of some machines of the latter type claiming to be able to turn out thoroughly dried copra in "two to three hours."

Either husks, shells (or in the case of the Birchfield method, the two materials attached), wood, or coal, can be used for fuel. Only the simplest type of boiler is required for furnishing steam; of course, a comparatively large grate is necessary if the husks are used; and in case the shells alone are burned, care must be taken to protect the sides of the furnace from the intense heat by means of sheet iron or similar material. The water condensing from the pipes in the drier returns, of course, to a tank or reservoir from which water is injected back into the boiler as often as required. Thus there is practically no expense for either fuel or water in operating a drier of this type.

The present drier cost about ₱600. A drier constructed along similar lines with reinforced concrete walls, boiler, and accessories complete, having a capacity of about 15,000 nuts per twenty-four hours, can be constructed for approximately ₱2,500.

The drier exhibited at the Exposition grounds was set up there before it had been tested or even assembled at the factory. Considering this fact the results obtained were exceptionally

good. A number of prominent copra dealers and owners of coconut plantations examined the drier in operation and were enthusiastic over the quality of the finished product. Several of these people wanted to buy the drier, stating that they were well satisfied with the results.

This drier will be taken to the Pandacan repair shops of the Bureau of Agriculture where exhaustive tests and experiments with it will be carried on for several months until accurate information has been obtained as to the most economical method of drying copra. The information thus obtained will then be published.

LIVE-STOCK SHOW, FIRST PHILIPPINE EXPOSITION.

By C. W. EDWARDS, *Agricultural Inspector.*

When we compare typical specimens of our present-day breeds of domestic animals with their progenitors or the foundation stock which was combined to produce them, it seems almost incredible that such results could have been attained mainly through the agencies of proper care, selection, and breeding—keeping in mind, of course, the ever-present influence of environment. Before the process of development could advance materially toward systematic improvement, however, it was necessary that certain standards be established toward which endeavor could be directed. One of the most potent factors instrumental in creating these standards was the live-stock show; this offered a means of assembling individual fragmentary ideas into a more or less definite or concrete form, resulting in the directing of community efforts toward the same end, following as the greatest good the raising of the general average of excellence of the animals of an entire section or country.

The shows of the Occident have now passed the formative period and their mission consists not so much in aiding the creation of new breeds, as in the further improvement of those already established; here, however, we are confronted with conditions and problems characteristic of no other country, and effort must be directed accordingly. Industrial expositions are still in the exploitative stage, and the work of the live-stock show at present lies not so much in striving toward the further development of the well-established breeds, but rather in providing an opportunity for the study of these with respect to their adaptability to our peculiar conditions, and their comparative value as a cross when used upon the various indigeneous types in the great work of up-grading the latter.

That there is a crying need for improvement in the animal-husbandry conditions of the country is evident by the great dearth of dairy, work, and beef animals, and the fact that the inferior native types are the certain results of wholly natural

generation—scarcely no attention having been given to breeding and selection. As one of the means toward remedying these conditions, the live-stock show was instituted three years ago and held in connection with the 1910 Carnival. Naturally, the obstacles to be overcome in this work are manifold, but in spite of these, if the large increase in number and quality of entries at this year's exhibit—as compared with those of the two former years—and the apparently sincere interest of the thousands of visitors is any criterion, very encouraging progress has been made. This increase in the number of entries is more significantly indicative of a growing public interest when we consider that many of the presentations came from the provinces.

Only enthusiastic compliment can be bestowed upon the showing made by the eighty-odd horses composing the twenty interesting classes. American and Australian pure breeds, native and Chinese types and crosses (mestizos) vied for ribbons which were very ably and impartially placed by Dr. J. A. McKinnon, W. H. Fell,¹ and José Gavito. The classes best and most creditably represented were those including the many native ponies and crosses (mestizos); a majority of the latter were sired by the Bureau stallions "Handrail" and "Chester, Jr.," the presenting of which should do a great deal toward removing the skeptical objection many Filipinos have to breeding their mares to pure-bred stallions. A feature of special mention was the Batangas collection of select ponies and grades, and the eight blue ribbons won by them furnish concrete evidence substantiating Batangas' claim as the producer of the best horses in the Philippine Islands. For this showing, the province was presented with a diploma for the best collective exhibit. The Bureau of Agriculture's entries included choice specimens of Arabians, Thoroughbreds, native ponies, and grades, the latter the get of Arabian and American sires from native dams and of native sires from American dams. The subprovince of Catanduanes sent a number of range horses which attracted considerable attention as examples indicating what can be accomplished by utilizing natural pastures exclusively. The animals found a ready sale during the exposition. The fact that this distant island participated in the show is most encouraging in that it indicates that the people of this district are giving attention to their live-stock interests. Catanduanes has nearly 4,000 horses and, according to the best of information, has always been free from serious equine diseases; nevertheless, owing to the fact that

¹ For the classes in which W. H. Fell had entries, E. J. Koert substituted as judge.

little if any attention has been paid to improvement, their animals are, for the most part, small and rough in conformation. The Bureau of Agriculture now has eight stallions in the island and the people are according hearty support to the work of upgrading their ponies.

Dairy and beef breeds, imported work bullocks, native types, and various crosses, composed the bulk of the cattle section. The exhibits of Jacinto Limjap and Alberto Sisi, made up of Shorthorns (milking strain) and Ayrshires, contained some very good illustrations of the bovine qualities sought in the dairy animal. Among the work animals were Indo-Chinese, a number from the Island of Formosa, Dalupiri bulls from the island of that name situated north of Luzon, and native types from the Province of Cagayan. The Formosa cattle, large importations of which have only recently been made, are apparently of Chinese origin, are smaller in stature than the Indo-Chinese, though more compact, and should make very good work animals. Eugenio Evangelista was the largest exhibitor in this class. The Bureau of Agriculture presented some superior specimens of Nellores and Herefords together with native and Chinese cows having grade calves at side, sired by bulls of the aforementioned and Galloway breeds. Of these, the Hereford grades elicited very favorable comment. The white faces have been most instrumental in improving the scrub ranger of America, and being animals of good rustling qualities, they are worthy of further experimentation in this country. Plans are now under way for the importation of more of these cattle. The winners in this division were chosen by W. N. Birch and E. S. Haskell.

The carabao division was represented by Indo-Chinese, native, and Indian types; this class presented a number of individuals of superior size and conformation. Faustino Lichauco led with the number of entries in the Indo-Chinese section and Mariano Molo exhibited the Indians. The latter is principally a dairy breed but also serves very well when used for draft purposes. It would seem that in this country, where there is a great scarcity of dairy stock, that there is a place for this class of animals. In certain sections the carabao is being replaced by the bullock, but there are immense areas devoted to rice growing where carabaos are, under present conditions, indispensable. The eager attention received and satisfactory sales made in this division were indications that to date, they still remain the most important work animals of the Philippine Islands.

From first to last, keen interest centered about the excellent display of porcine merits exhibited by the Berkshire and Chester-White pure breeds and the half and three-quarter grades. At present swine raising and improvement is receiving a great deal of attention and all animals offered for sale were readily disposed of at fancy prices and many times the number could have been sold. The Berkshires were easy winners with respect to numbers and quality of individual entries. Owing to their prolificacy and prepotency, the introduction of this breed is proving a boon to swine husbandry in this country and the grades were valuable object lessons demonstrating the Berkshire's sterling merit as a cross for the inferior native "razor backs." The largest class in the division was the "foreign breeds, native-bred," with E. Wickham offering the greatest number of entries. The Bureau of Agriculture showed some excellent imported sows and boars from the breeding herd at the Alabang stock farm. The placings in this department were made by J. L. Fattley.

The poultry section, filled with many exceptionally fine birds representing twenty different breeds and varieties, was exceedingly popular with the many visitors. Leghorns, Cochins, Orpingtons, Plymouth Rocks, and Langshans made up the largest portion of the display and numbered many of the choicest fowls presented. Manuel Sequera, A. L. Barden, and Mrs. A. J. Neal were the largest exhibitors. An encouraging feature of the exhibition was the entries from the Manila schools. Honorio Lasám presented a unique entry of wild chickens, and crosses of same with native fowls, from the Cagayan Province. The large demand for fresh poultry products and breeding stock in Manila and the larger provincial towns offers a tempting inducement for one to engage in the business commercially. However, the greatest benefit resulting is the dissemination of knowledge among the masses of the Filipino people, placing them in a position to produce more food for their own consumption. Already the observer will note in many a farmer's yard a prevalence of mestizo fowls, concrete examples of the good already accomplished by the pioneer importers and breeders. Capt. George Seaver and Carl F. Preusser acted as judges in this division.

The judging of all classes took place February 9, and the winners of first and second places were awarded ribbons and diplomas.

A list of prize winners and their respective addresses follows:

HORSES.

Imported coach breeds:

- First Lieutenant Miller, Fort McKinley.
 Second W. H. Fell, American Livery Stable, Escolta,
 Manila.

Imported light-harness breeds:

Stallions—

- First Dr. Roberto Chuidian, Manila.
 Second..... José Oliver, 90 Carriedo, Quiapo.

Mares—

- First Chas. H. W. Aitken, El Varadero, Cavite.
 Second..... Messrs. Roseburg & Berger, 149 Rotonda, Sampaloc.

Geldings—

- First W. H. Fell, American Livery Stable, Escolta,
 Manila.
 Second..... Messrs. Roseburg & Berger, 149 Rotonda, Sampaloc.

Imported brood mares:

- First J. Giloy, 421 Rotonda, Sampaloc.
 Second..... C. D. Squires, 100 Santa Clara.

Imported horses under 14 hands:

- First W. H. Fell, American Livery Stable, Escolta.
 Second..... W. H. Fell.

Cochin China pony class:

Mares—

- First J. Giloy, 421 Rotonda, Sampaloc.
 Second..... C. W. Hubbell, 22 Sandejas, Malate.

Geldings—

- First Faustino Lichauco, 33 Plaza Cervantes.
 Second..... J. Giloy, 421 Rotonda, Sampaloc.

Foreign breeds, native-bred:

Stallions—

- First Chas. H. W. Aitken, El Varadero, Cavite.
 Second..... San Nicolás Fire Station, Manila.

Mares—

- First San Nicolás Fire Station, Manila.

Foreign-native cross:

Stallions over 48 months—

- First Mauro Prieto, 964 San Sebastian, Manila.
 Second..... Gregorio Agoncillo, Lipa, Batangas.

Stallions under 48 months—

- First Mariano Katigbac, Lipa, Batangas.
 Second..... Leopoldo Almeda, Tanauan, Batangas.

Stallions under 36 months—

- First Proceso Mayo, Lipa, Batangas.
 Second..... Vicente Luntoc, Taal, Batangas.

Mares over 48 months—

- First R. B. Genato, 852 San Sebastian.
 Second..... Faustino Lichauco, 33 Plaza Cervantes.

Mares not over 48 months—

- First Major Jones, Bureau of Constabulary, Manila.
 Second..... Cipriano Lopez, Balayan, Batangas.

Native:

Stallions over 48 months—

First S. M. Berger, 255 Alix, Sampaloc.

Second..... Santos Sarmiento, Lipa, Batangas.

Stallions not over 48 months—

First Miguel Lozano, Lipa, Batangas.

Second..... Victor Templo, Lipa, Batangas.

Mares—

First Thos. L. Finnerty, 551 Cervantes, Santa Cruz.

Second..... E. H. Koert, Virac, Catanduanes.

Native range ponies:

Stallions—

First Cecilio Arcillo, Virac, Catanduanes.

Second..... Valentin Francisco, Virac, Catanduanes.

Geldings—

First Valentin Francisco.

Second..... Valentin Francisco.

CATTLE.

Imported dairy breeds:

Bull—

First Jacinto Limjap, 48 Estero Cegado, Santa Cruz,
Manila.

Female over 2 years—

First Jacinto Limjap.

Second..... Jacinto Limjap.

Imported draft breeds, Chinese or Indo-Chinese:

Bull over 2 years—

First Eugenio Evangelista, 112 Clavel, Binondo.

Second..... Faustino Lichauco, 33 Plaza Cervantes.

Female over 2 years—

First Eugenio Evangelista, 112 Clavel, Binondo.

Second..... Eugenio Evangelista.

Foreign breeds, native-bred:

Bull over 2 years—

First E. G. Limjap, 48 Estero Cegado, Santa Cruz.

Second..... Alberto Sisi, 663 Alix, Sampaloc.

Female over 2 years—

First Alberto Sisi.

Second..... E. G. Limjap.

Female under 2 years—

First E. G. Limjap.

Second..... Alberto Sisi.

Foreign-native cross: Bull over 2 years—

First Government of Isabela.

Native breeds:

Bull over 2 years—

First José Aldecoa, 9 Plaza Moraga, Binondo.

Second..... José Aldecoa.

Bull not over 2 years—

First Pastor Macanaya, Tuguegarao, Cagayan.

Second..... Pastor Macanaya.

Female over 2 years—

First E. G. Limjap, 48 Estero Cegado, Santa Cruz.

CARABAOS.

Imported draft breeds:

Bulls over 2 years—

First Faustino Lichauco, 33 Plaza Cervantes.

Second..... Faustino Lichauco.

Castrated males any age—

First Faustino Lichauco.

Second..... Faustino Lichauco.

Native draft breeds:

Bulls not over 3 years—

First Pastor Macanaya, Tuguegarao, Cagayan.

Females not over 3 years—

First Pastor Macanaya.

Second..... Mariano Molo, Pasay, Rizal.

Dairy breeds, imported or native:

Bulls over 3 years—

First Mariano Molo, Pasay, Rizal.

Females over 3 years—

First Mariano Molo.

Second..... Mariano Molo.

Females not over 3 years—

First Mariano Molo.

Second..... Mariano Molo.

SWINE.

Imported: Female over 1 year—

First J. R. Keykendell, 249 San Andres, Malate.

Foreign breeds, native-bred:

Male over 1 year—

First J. R. Keykendell.

Second..... E. Wickham, 465 Santa Mesa.

Male not over 1 year—

First E. Wickham.

Female over 1 year—

First E. Wickham.

Second..... E. Wickham.

Female not over 1 year—

First E. Wickham.

Second..... E. Wickham.

Foreign-native cross:

Female over 1 year—

First E. L. Worcester, Cabanatuan, Nueva Ecija.

Female not over 1 year—

First Wm. Wolfert, Tondo Fire Station.

Second..... J. R. Keykendell, 249 San Andres, Malate.

Female and litter—

First A. J. Gibson, 522 Nueva, Ermita.

Second..... J. R. Keykendell, 249 San Andres, Malate.

Native:

Male not over 1 year—

First B. Fernandez, 881 Isaac Peral, Ermita.

Female not over 1 year—

First B. Fernandez.

SHEEP AND GOATS.

Southdown buck:

First E. L. Worcester, Cabanatuan, Nueva Ecija.

Native goat:

First José Xeres Burgos, 167 Lamayan, Santa Ana.

POULTRY.

Light Brahmas: Trio—

First Manuel Sequera, 30 Alix, Sampaloc.

Second..... Manuel Sequera.

Barred Plymouth Rocks:

Cock—

First A. J. Neal, 1542 Real, Malate.

Second..... A. L. Barden, 99 Dominga, Pasay.

Cockerel—

First Maxima Sakay, Manila.

Second..... Maxima Sakay.

Hen—

First A. J. Neal, 1542 Real, Malate.

Second..... A. L. Barden, 99 Dominga, Pasay.

Pullet—

First A. J. Neal.

Second..... A. J. Neal.

Trio—

First Thos. L. Finnerty, 551 Cervantes.

Second..... A. L. Barden, 99 Dominga, Pasay.

Black Orpingtons:

Cock—

First Pandacan School.

Hen—

First Pandacan School.

Black Langshans:

Cock—

First Pandacan School.

Cockerel—

First José Xeres Burgos, 167 Lamayan, Santa Ana.

Hen—

First Pandacan School.

Second..... Pandacan School.

Native: Trio—

First Capt. Wm. Wolfert, Tondo Fire Station.

Pit Game:

Cock—

First Honorio Lasám, Tuguegarao, Cagayan.

Second..... Bernabe Aquino, Tuguegarao, Cagayan.

Hen—

First Honorio Lasám.

Second..... Honorio Lasám.

Indian game: Trio—

First A. J. Neal, 1542 Real, Malate.

American White Leghorns:**Cock—**

First A. L. Barden, 99 Dominga, Pasay.

Cockerel—

First A. J. Neal, 1542 Real, Malate.

Second..... A. L. Barden.

Hen—

First A. L. Barden.

Best display—

First A. J. Neal.

Second..... A. L. Barden.

Australian White Leghorns:**Cock—**

First Pandacan School.

Second..... Pandacan School.

Cockerel—

First Pandacan School.

Second..... Pandacan School.

Hen—

First Pandacan School.

Best display—

First Pandacan School.

Rhode Island Reds: Trio—

First A. J. Neal, 1542 Real, Malate.

Haudans: Trio—

First Manuel Sequera, 30 Alix.

Mixed foreign breed: Trio—

First Manuel Sequera.

Foreign breeds:**Chinese chickens—**

First E. F. Cheney, 1127 Leveriza, Malate.

Second..... E. F. Cheney.

Java game cock—

First E. F. Cheney.

Buff Orpington: Trio—

First Pandacan School.

Second..... Manuel Sequera, 30 Alix.

Silkies:**Cock—**

First A. J. Neal, 1542 Real, Malate.

Hen—

First A. J. Neal.

Wild chickens:**Cock—**

First Honorio Lasám, Tuguegarao, Cagayan.

Hen—

First Honorio Lasám.

Ducks:

First B. Fernandez, 881 Isaac Peral, Ermita.

THE PROVINCIAL EXHIBITS, FIRST PHILIPPINE EXPOSITION.

By O. W. BARRETT,

Chief, Division of Experiment Stations, Bureau of Agriculture.

There is no question but that agricultural materials in the First Philippine Exposition comprised by far the larger portion of the exhibits from the various Insular provinces, and this means that not only do the authorities and exhibitors fully realize the preponderance of agriculture over all other lines of development in the Islands, but it also shows that there is but little with which to make a really first-class display outside of the products of the soil.

Generally speaking, the arrangement of these exhibits was good and in several instances the logical grouping and the decorative art ideas in evidence were excellent. If any adverse criticism could be made on the displays, as a whole, it could be, perhaps, the common fault of inadequate labeling; this to the ordinary exhibitor is an insufficiently appreciated subject, since he can not regard the materials from the point of view of the casual observer; however, he frequently can not obtain at short notice, during the unpacking and arranging of exhibition objects, such labels and placards as are almost necessary for the due understanding of the individual exhibits.

The provinces were apportioned sections in four large buildings arranged on either side of "Prosperity Row," extending from the Bureau of Education Building on the west to Machinery Hall at the east end of the grounds. These booths varied in size from two to four units, each unit being 5 meters in frontage; the depth of each allotted space was 18 meters. The lighting, both during the daytime and night, was more than was to be expected, though on the rainy days at the beginning of the Exposition the public had some difficulty in examining the materials in the inner portions of the booths.

Since the exhibits from no two provinces were at all alike

it may be of interest to mention the principal agricultural features shown in each provincial section:

La Union.—This province rivaled Ilocos Sur and Ilocos Norte in the display of native cotton fabrics; the exhibit of blankets, towels, etc., woven from homegrown cotton, was especially interesting, and the native hand-loom illustrating the method of weaving these cloths was an added attraction.

A collection of fish nets and baskets decorated a portion of the wall.

A fair lot of vegetables and a good collection of rice "heads," maize, copra, and tobacco was in evidence.

The basket and shell work made at and displayed by the industrial schools of the province compared favorably, though not in so great a variety of designs, with the other provinces.

The white "tugue," or yam, was featured as one of the decorative materials of a special booth; this is believed to be the whitest and best yam of its size in the world.

Ilocos Sur.—Splendid specimens of the famous Ilocano towels, table covers, and coarse cotton goods were in evidence, and looms for weaving same were in operation. Beautiful specimens of embroidery were also shown. Samples of maguey fiber were, of course, exhibited, since this province excels all others as a producer thereof.

Harness, saddles, and general leather work were shown to good advantage.

A good display of unfinished hand-made chairs, furniture, boxes, etc., was shown. Matting, in fair variety of design, decorated the walls.

The famous Abra tobacco, from the subprovince of that name, was also shown here.

Presumably on account of the bad season the farm products, especially maize, were not in first-class condition. The coconuts were above the average in size.

Specimens of silver work, such as cane-heads, spoons, etc., of exquisite Ilocano designs, attracted considerable attention.

Capiz.—A fine display of palm-fiber fabrics made an imposing display in this section. Fine specimens of buri cloth, both uncolored and dyed, decorated the walls. Matting, of both buri and nipa, and basketwork, ropes, hats, etc., made from cabo negro and buri, were in evidence.

Excellent samples of piña cloth, together with a Visayan loom for making the same, drew much attention. Beautiful samples of abacá were shown, though this province makes no great claims in the production of that crop.

Samples of fully 200 varieties of rice, attractively displayed both as bundles of baled heads and in baskets of shelled grain, were in evidence.

Other objects of special interest were: Beautiful specimens of shell-flower work; artificial wreaths; a hat made from the fiber of one "dish-cloth" gourd, or luffa; specimens of cloth woven from the famous Capiz cotton; beautiful jusi and piña embroidered; also a fine embroidered fan made of piña; samples of lignite, and kaolin, or "yeso."

Bulacan.—Colored mattings covered the walls of this very artistically arranged exhibit and a fine collection of jusi fabrics was featured, together with the jusi loom of the province.

Fine specimens of pandang chairs, guano samples, bricks, building stone, and a model iron forge representing the native method which has been used for many years in the province, were shown.

Among the horticultural materials a display of excellent carabao mangos, several varieties of bananas, rootcrops, and a fine watermelon were shown, also a good collection of rice.

A great variety of mats, hats, and basketwork adorned the walls and specimens of rattan hats, worth up to ₱100, as well as cheaper samples made of buri and bamboo, were also shown.

Occidental Negros.—As would be expected, the first object to strike the visitor's eye on entering this section was an exhibit of sugar; Señor Esteban de la Rama, from Talisay, Bacolod, exhibited samples of genuine centrifugal sugar, a heretofore almost unknown substance in the Philippines.

Beautiful specimens of abacá, both in the rough and made up, adorned the walls and pillars of the section; huge specimens of the stems, one about 6 meters in height, surrounded the central booth.

A unique center cabinet, made in mosaic from cabo-negro chips and strips, formed a beautiful exhibit; and two lions carved from single blocks of molave wood guarded the entrance of the section.

A gigantic honeycomb hung in the rear of the section and a specimen of extracted wild honey was near by.

Fine specimens of piña cloth and a collection of shells filled the central cabinet. Some 387 varieties of rice were arranged in the rear of the booth.

Fine bundles of bejuco, both in coils of unfinished stems and as manufactured articles, were in evidence. Samples of cordage and ropes, made from cabo negro and buri fibers were also shown.

A good collection of native rootcrops, timbers, and grains in

abundance were displayed; also tobacco, maize, and fine specimens of sun-dried copra.

Interesting samples of mineral products, such as coal, sulphur from Monbucal (near Canlaon), "yeso," and almáciga were in evidence.

Isabela.—This province made little effort to make a display of anything except its famous tobacco; this, however, was in striking variety, both as to raw product and manufactured article.

Three record-breaking bejuocos, one 120, one 140, and one 160 meters in length, were shown.

A collection of baskets made from various materials and fine specimens of kaolin were seen.

Oriental Negros.—The exhibit of this province included the following noteworthy articles: A commercial bale of kapok ready for shipping to mattress and life-preserver manufacturers together with a quantity of the natural product in pods and partly ginned, from the plantation of Mr. Henry Fleisher at Dumaguete.

Cane, maize, tobacco, rice, and coconuts decorated the walls.

A collection of coconut pests, including a rare kind of beetle several times the size of the ordinary "uang," or rhinoceros beetle, were shown.

The Silliman Institute at Dumaguete exhibited a wonderful display of furniture and bric-a-brac made from the famous camagon; among these was a desk of which any cabinetmaker in any country in the world could well be proud, the contrasting black and smoky-brown markings of the wood "holding the eye" of the observer.

Cebu.—The large section occupied by the exhibits of this province contained materials enough for an entire day's careful study. A central pavilion covered with corn, corncobs, nipa fruits, coconuts, etc., was a striking feature; the arches were hung with portières composed of maize kernels and mungo seeds.

A large lot of samples of cotton, piña, and jusi cloths was shown.

Basketwork in great variety made of fibers and rattan was also in evidence.

There was a collection of rootcrops, among which was the largest yam shown at the Exposition. Specimens of maguey and sansevieria, as well as abacá, were in evidence. There was also a loom for weaving jusi and piña.

Misamis.—Among the numerous interesting specimens ex-

hibited by this province must be mentioned the guano from the vicinity of Cagayan (evidently from bat caves), "yeso," gutta-percha, resin (almáciga), beeswax, matting, and mineral water from the volcanic island of Camigin.

Live tortoise-shell turtles occupied a prominent place in a tank at the entrance while two snakes occupied a dark corner at the rear.

The walls were decorated with abacá, palm mats, etc.

Batangas.—The walls of the exhibit were covered with sugar cane, maize, mats, and cloths in great variety.

A special horticultural feature was, of course, the famous Batangas naranjita, or Mandarin orange. Due to the enthusiasm and good example of the agricultural schools in the province there was a display of hundreds of orange and cacao seedling trees in pots, excelling all other similar displays at the Exposition. Samples of cotton, both brown and white, were shown, and a large number of rice varieties, grains, etc., were in evidence.

As a sad reminder of the lost coffee industry in this province, a few samples of Liberian, instead of the good old Arabian coffee, were displayed.

The weaving of jusi was shown in a booth on the right while the center was occupied by a magnificent display of embroidered cloths.

Nueva Ecija.—Though occupying a comparatively small space, this province displayed some 256 varieties of rice, both in sacks and unthreshed heads, attractively placarded. The ceiling of the section was fancifully decorated with flower-like clusters of tobacco leaves and rice heads.

A pillar covered with wool formed a unique exhibit in the center of the section. As evidenced by specimens of various kinds of calesas, the wheelwright profession is a worthy one in this province. Blocks of wood from which these vehicles were made were also shown.

Shoes and chinelas, in great variety, together with mats, hats, towels, blankets, etc., decorated the walls while a cotton loom in operation attracted considerable attention.

Sugar occupied a small but rather important place in this province's products.

Iloilo.—As would be expected, the center of this large section was occupied with five looms for weaving piña and jusi cloths and the walls of the booths were decorated with beautiful specimens of the latter, flanked by cane, palay, tobacco, maize, and even, in one corner, a huge pile of unhusked coconuts.

To examine carefully the exhibit of jusi and piña cloths and embroideries would require at least one day for this province alone; it is undoubtedly the center of the industry for the whole Archipelago.

Hammocks and hats in process of making were shown.

Samples of building stones, limestone, and earthenware water filters were exhibited.

About 110 varieties of rices claimed attention and specimens of excellent sun-dried copra were seen.

On account of the drought the exhibit of rootcrops was deplorably small. Two types of the rare "ivory," or white coconut, were in evidence. Bamboo chairs and a full line of fishing apparatus claimed the sightseer's attention.

Tarlac.—In the center of this large section was shown a model rice plantation showing the standing crop, a stack of unthreshed grain, implements for handling the crop, and a model house of a rice-estate superintendent.

The walls were decorated with basketwork, matting, rice, cane, tobacco, and coconuts. Building materials and earthenware occupied a prominent place, especially the water coolers with spigots.

About 300 specimens of rice were shown, and sesamun, tobacco, coconuts and cane were in evidence.

La Laguna.—The entrance to this praiseworthy exhibit was fancifully decorated with ornamentals and a generous display of the ubiquitous coconut which has made this province so famous.

Among the coconut products exhibited were alcohol, running from 40° to 80° pure, vinegar, sugar, and oil—one specimen of the latter being nearly white. A striking feature was the giant pandanus which is practically confined to this province (one plant having leaves fully 4 meters in length); one of the fruits of this pandanus, as large as an ordinary jakfruit, was in evidence.

Some eight presumably distinct varieties of bejuco, or rattan, formed an interesting exhibit in the rear of the section.

The famous Santa Cruz glazed earthenware, in great variety of style, was in evidence.

A fine collection of fruits, vegetables, and rootcrops attracted considerable interest. Hats, mats, and articles for house decoration were displayed.

The famous Isuan and Makiling bottled waters were, of course, a prominent feature of the exhibit.

Tayabas.—This province closely rivaled La Laguna in the

matter of coconuts and copra exhibits. Near one entrance were seen the rare guimaring, or "ivory" coconut, a huge giant variety (one nut measuring 85 centimeters in circumference), also a red nut, and several dwarf types. This province may well be proud of its coconut crop since it already produces about 18 per cent of the copra of the Philippines from more than 6,000,000 trees, the annual export value being about ₱5,000,000.

Samples of La Nita coconut alcohol, made in Tayabas, were shown, together with coconut oil and a collection of tools for gathering and handling the nuts.

Looms for weaving sinamay, or abacá cloth, were shown in operation, and splendid samples from Marinduque Island attracted much attention.

The exhibit of pili nuts together with a quantity of pili resin, or "gum elemi" (white dammar) was in evidence. Lumbang nuts were also shown. The walls were decorated with abacá and matting samples.

The Mainit mineral water was here in evidence.

The largest block of coal ever mined in the Philippines and a unique exhibit of petroleum from Mulanay on the Bundog Peninsula were shown. A large number of commercial timber samples were also exhibited.

Mindoro.—The rear portion of the section allotted to this province was arranged as a miniature mountain, the slopes of which were covered with orchids, ferns, and aroids; parrots, deer, and the wild jungle fowl, ancestor of our domestic poultry, drew great attention. At the entrance to the exhibit was a fine mounted specimen of the famous timarau, which is perhaps the rarest large mammal in the world. A pillar at the entrance of the section was covered with a fine collection of sponges, which appear to be confined largely to this province, as a commercial enterprise, at least. A giant sugar cane 7.9 meters (over 26 feet) in length was shown. A wooden tray made of one narra block, 1.58 meters (5 feet 3 inches) in diameter, was shown.

The longest single piece of rattan at the Exposition was found here, it measured not less than 192 meters (624 feet) in length.

Abacá from Calapan was also shown, and a collection of minerals and kaolin was in evidence. Dried yam chips together with wild roots from which this "condensed-ration" food product is made were shown.

A huge block of honeycomb from the vast forests of this soon-to-be famous island was in evidence.

Bohol.—Among the principal exhibits of this province were the specimens of copra which easily exceeded all other samples

shown, as well as seed coconuts (also of the best), yams, sugar, maize, mats, abacá, and rice. Three features of the exhibit were especially worthy of attention, namely: The two types of guano, one from bat caves and the other a phosphate guano; a cage containing living colugos, or flying lemurs, was to be seen at one of the entrances; a fine collection of skins of this exceedingly rare animal decorated the walls.

Samples of banana (sabá) cloth, as well as sinamay and cotton, were well worthy of study.

Antique.—The principal exhibits of this province consisted of fiber cloths, rice, in good variety, cane, and various forms of sugar. Coal and splendid almáciga (semifossil resin) were also shown.

Leyte.—A fine collection of rice varieties occupied a prominent place in the exhibit of this province and the walls were fancifully decorated with mats and various native cloths. Abacá was a prominent feature and looms for weaving native cloths were displayed. A collection of rootcrops also drew considerable attention.

Ambos Camarines.—A cabinet containing a large set of samples from the famous Paracale gold mines occupied a prominent place in this section.

Coconuts were by no means an insignificant factor, and abacá was everywhere, of course.

Samar.—A great feature was made of the display of rattan, vegetable fibers, and woods; coal was also shown, and the rootcrops, grains, etc., compared favorably with those of more highly developed provinces.

Mountain Province.—By far the most striking feature of the kind in the whole Exposition was the native iron-working apparatus; both Kalinga and Igorot methods were in operation. Native Kalinga looms made with no wooden framework were shown in operation. Specimens of the native cloths and weapons were used to cover the walls of the exhibit.

Moro.—The prime feature of this exhibit was the Pará and Ceará rubber samples from Basilan Island; this rubber, which it appears has held its own with the cultivated rubber of Malaya, was well worthy of study, although the arrangement of the exhibit was perhaps not above criticism.

Coffee, gutta-percha, maize (a first-class cross of Mexican June and a native flint corn), tobacco, abacá, cacao, and coconuts were in evidence.

Mats and a fine collection of Moro brasses, weapons, cloths, and beadwork formed a striking feature of the exhibit.

Pangasinan.—The ceiling of this section was artistically made by suspending heads of rice, while the center was occupied with a huge mountain of the same material. The walls were decorated with coconuts, cane, and rice. Though the variety of materials left something to be desired, the arrangement of the display was certainly one of the most artistic of the Exposition.

Ilocos Norte.—The comparatively small space allotted to this province was well filled with looms for the native cotton cloths, rattan specimens, tobacco, and kapok.

The Batak School farm's fine exhibit of fruits and vegetables was displayed in the Bureau of Education Building.

Albay.—The ceiling of this section was made of abacá draped into huge waves and festoons, this province having long been famous for that fiber. Three types of abacá-stripping machines were in evidence and from time to time were put in operation for the benefit of the public. The Island of Catanduanes also exhibited interesting specimens of rice and roots of the largest cultivated aroid (*Cyrtosperma merkusii*). Fine specimens of buri were in evidence as also looms for weaving native cloths. Copra, cacao, grains, etc., claimed attention, while great masses of orchids and ferns hung from the ceiling.

Cagayan.—The rather limited space for this province was well filled with a miniature field of tobacco plants, showing the method of cultivation, while the walls were decorated with basketwork, native weapons, tobacco, etc. Fine samples of almáciga were shown.

Cavite.—The ceiling of this section was roofed in with the window shell which is one of the principal products of the province. The collection of vegetables, fruits, and grains was above the ordinary; several varieties of bananas were of interest and are probably more or less confined to the province. A loom in operation occupied a prominent place, and sinamay cloths, abacá, sugar, and basketwork held the sightseer's eye.

Pampanga.—The background of this section was arranged in a very striking way as a country scene with fields of the different crops, mountains, terraces, etc., in view. The collection of vegetables and fruits was perhaps the best of all the provincial exhibits. Various types of matting decorated the ceiling and walls and fruiting nipa palms adorned the entrance.

Nueva Vizcaya.—Due presumably to the drought the agricultural products, with the exception of rice, cane, and tobacco, did not occupy a prominent place in this section. Blankets and other specimens of native cloth and matting work were shown.

AGRICULTURAL-HORTICULTURAL AWARDS¹ AT THE FIRST PHILIPPINE EXPOSITION.

Committee on Awards.

F. W. TAYLOR, Chairman.
E. B. COPELAND.
H. T. EDWARDS.
F. W. SHERFESEE.

COCONUTS.

- Best five seed-nuts:
First Catalino Casinas, Bohol.
Second..... José Nugarin, Cebu.
Honorable mention..... Antonio Miñosa, Cebu.
- Most copra from one nut:
First M. Literal, Oriental Negros.
Second..... Catalino Casinas, Bohol.
Honorable mention..... E. S. Gotaner, Nueva Ecija.
- Best picul of copra:
First Catalino Casinas, Bohol.
Second..... E. Matias, Albay.
Honorable mention..... P. O. Mirjan, Tayabas.
- Copra richest in oil:
First Henry Fleisher, Oriental Negros.
- Best sample of oil:
First E. F. Malvar, La Laguna.
Second..... E. S. Gotaner, Nueva Ecija.
- Best sample of coconut fiber:
First Eladio Sablan, College of Agriculture.
Honorable mention..... Zacarias Albay, Capiz.

ABACA.

- Longest fiber:
First Ohta Development Co., Davao.
Second..... Vicente Sanchez, Mindoro.
- Strongest fiber:
First Pardo Barrios, Ambos Camarines.
Second..... Gerardo Quibo, Oriental Negros.
Honorable mention..... Wilson Plantation Co., Davao.
- Finest fiber:
First S. A. Coronel, Cavite.
Second..... Fausto Anciro, Cavite.
Honorable mention..... Juan Araneta, Occidental Negros.

¹ These awards were based on exhibits made in the Provincial and Agricultural-Horticultural Buildings.

Best fiber :

- First Felipe de Morente, Mindoro.
 Second..... Wilson Plantation Co., Davao.
 Honorable mention..... Ohta Development Co., Davao.

Best hat-making fiber:

- First Aldamio Sobrino, Mindoro.

MAGUEY.**Best sample of maguey:**

- First Maximo Alfafara, Cebu.
 Second..... Gregorio Florida, Cebu.
 Honorable mention..... Leona Inocelda, Ilocos Sur.

PINEAPPLE FIBER.**Best sample of pineapple fiber:**

- First Florencio Bagui, College of Agriculture.

TOBACCO.**Best wrapper leaf:**

- First Julian Sanson, Isabela.
 Second..... Mrs. Venancia Periera, Isabela.

Best plug-tobacco leaf:

- First Felix Paggao, Isabela.
 Second..... Joaquin Ortega, Ilocos Sur.

Best cured tobacco:

- First Mrs. Venancia Periera, Isabela.
 Second..... Angel Garces, Cagayan.

Largest sound tobacco leaves:

- First Ruperto Amadora, Cebu.
 Second..... Pedro Sanson, Isabela.

SUGAR.**Best exhibit of five stalks:**

- First Hacienda Tinang, Tarlac.
 Second..... Sebastian Visitación, Oriental Negros.

Heaviest cane:

- First Juan Araneta, Occidental Negros.
 Second..... Vicente Sanchez, Mindoro.

Best purple cane:

- First Florencio Noel, Cebu.
 Second..... Demetrio Lorena, Oriental Negros.

Best green or yellow cane:

- First Pantaleon Galura, Nueva Ecija.
 Second..... Luis Ferrer, Cavite.

Best assortment of varieties:

- First Maximino Jalandoni, Iloilo.
 Second..... Julia Paras, Pampanga.

Best sugar ready for market in containers:

- First Inchausti & Co., Iloilo.
 Second..... Alejandro Policarpo, Nueva Ecija.
 Honorable mention..... Viuda de Tagle, Oriental Negros.

Best panocha:

- First Tomas del Mundo, La Union.
 Second..... Bonifacio Ermitaño, Cavite.

COFFEE.**Best sample:**

- First Pedro Gaco, Cebu.
 Second..... Segunda Alisangco, Ilocos Sur.
 Honorable mention..... Sr. Yap, Cebu.

CACAO.**Best sample:**

- First Bartolomé Bañares, Albay.
 Second..... Segunda Alisangco, Ilocos Sur.
 Honorable mention..... Paulino Dianco, Capiz.

RICE.**Best paddy rice:**

- First C. R. Manuel, Nueva Ecija.
 Second..... José Sociapco, Tarlac.

Best upland rice:

- First Mandao,¹ Bukidnon.
 Second..... Dulian,¹ Ifugao.

Best glutinous rice:

- First Arcadio Recometa, Nueva Ecija.
 Second..... Augustino Alvarez, Capiz.

Best pinipig:

- First A. de Alvarez, Capiz.

Heaviest five heads of grain, in head:

- First E. L. Worcester, Nueva Ecija.
 Second..... Vicente Melencio, Nueva Ecija.

CORN.**Best exhibit of five ears:**

- First J. Spirig, Moro Province.
 Second..... Florencio Noel, Cebu.
 Honorable mention..... Antonio Gonzaga, Occidental Negros.

Heaviest liter of shelled corn:

- First J. Spirig, Moro Province.
 Second..... Antonio Gonzaga, Occidental Negros.

MILLET.**Best exhibit of ten heads:**

- First Pedro Rances, Bohol.
 Second..... Faustino Salvador, Cebu.

SESAMUM.**Best liter of seed:**

- First Honorio Lasám, Cagayan.
 Second..... José Sociapco, Tarlac.
 Honorable mention..... José Barrios, Capiz.

CORN-BLADE FODDER.**Best sample:**

- First Chas. Schück, Jolo.
 Second..... Pablo Tan, Leyte.
 Honorable mention..... Florencio Noel, Cebu.

¹ Non-Christians.

DRY FORAGE.**Best sample:**

- First Albert F. Keil, Moro Province.
 Second..... Leandro Reyes, La Laguna.
 Honorable mention..... R. T. West, Moro Province.

GREEN FORAGE.**Best sample:**

- First M. Magno, Rizal.

RUBBER.**Best sample:**

- First Basilan Plantation Co., Moro Province.

TAPIOCA STARCH.**Best sample:**

- First B. M. González, College of Agriculture.
 Second..... Vicente Bartolomé, College of Agriculture.

ARROWROOT STARCH.**Best sample:**

- First Pablo Ligones, Bohol.
 Second..... Daniel Dado, Capiz.
 Honorable mention..... Juan Lomuntad, Samar.

TACCA STARCH.**Best sample:**

- First Amando Laparan, College of Agriculture.

SWEET POTATOES.**Best exhibit:**

- First Eugenio Villanos, Tarlac.
 Second..... Miguel Cordova, Capiz.
 Honorable mention..... Severino Claren, Bohol.
 Honorable mention..... Chas. Shauger, Samar.

YAMS.**Best exhibit:**

- First Felipe Sespon, Bohol.
 Second..... Ruperto Sarmiento, Cebu.
 Honorable mention..... José Bugarin, Cebu.

GARDEN TRUCK.**Best tomatoes:**

- First Frederick Fisher, Pampanga.
 Second..... Enrique M. Barretto, Rizal.

Best potatoes:

- First Wenceslao Vabra, Nueva Vizcaya.
 Second..... Pantaleon Bacomo, College of Agriculture.

Best chili:

- First Pantaleon Bacomo, College of Agriculture.

Best squashes and gourds:

- First Inocencio M. Delgado, Bulacan.
 Second..... Vicente Rivera, La Union.

Best sincamas:

- First Pelagia Serrano, Tarlac.
 Second..... Rafael Sarmiento, La Union.
 Honorable mention..... Inocencio M. Delgado, Bulacan.

Best cabbage:

- First Ceferino Joven, Pampanga.

FRUITS.**Best bananas:**

- First Buenaventura Dimaguila, La Laguna.
 Second..... Inocencio Delgado, Bulacan.

Best citrus fruits:

- First Nicolas Alba, Capiz.
 Second..... Felix Cuenca, Cavite.

Best mangos:

- First G. Medina, Cavite.

Best general collection of fruits:

- First Lais Trading and Development Co., Davao.

NURSERY EXHIBIT.**Best nursery exhibit:**

- First Tanauan Intermediate School.

ORNAMENTAL PLANTS.**Best general exhibit:**

- First Luzon Floral Co., Manila.
 Second..... Regino Fermin, Manila.
 Honorable mention..... Wm. S. Lyon, Manila.

PEANUTS.**Best exhibit:**

- Honorable mention..... Macario Gantuanco, Cebu.

KAPOK.**Best exhibit:**

- Honorable mention..... Henry Fleisher, Oriental Negros.

CASTOR BEANS.**Best exhibit:**

- Honorable mention..... Gelasio Tabiana, Iloilo.

GINGER.**Best exhibit:**

- Honorable mention..... Josefa de Guzman, Bulacan.

GABI.**Best exhibit:**

- Honorable mention..... Solano Anceta, Samar.

MUNGO.**Best exhibit:**

- Honorable mention..... Agapito Tating, Antique.

THE MACHINERY EXHIBITS, FIRST PHILIPPINE EXPOSITION.

By FRANK L. STRONG, M. E.

The machinery exhibits at the Manila Exposition of 1912 were far in advance of those of former years and are an indication of the rapid increase in the use of machinery in the Islands. The range covered was extensive, the samples shown were the best of their class, and interest was enhanced by many of the machines being shown in actual operation.

The Government coöperated with exhibitors as never before, lending every assistance in providing a large and suitable building, steam boilers and other essentials. The exhibitors owe much to Capt. Frank P. Helm, Director of Navigation, who was in charge of the erection of the building and its decorations, and who was untiring in his assistance with a large working force of laborers. Under his supervision a beautiful electrically lighted fountain was placed at the main entrance to the building, adding greatly to the scenic effect. Every portion of the great building was ablaze with electric lights, machines innumerable were in motion, and crowded as it was at all hours with delighted and astonished spectators the Machinery Hall was beyond question the most attractive feature of the Exposition.

The main portion of the building was in the form of a rectangle, with wings at either end. Entering the southern wing one was attracted first by the exhibit of the Philippine Acetylene Company, where, in addition to lights, a new process of welding was shown, large pieces of cast iron being perfectly and quickly welded. Near by were exhibits of the Alhambra Cigar and Cigarette Manufacturing Company, the Germinal Cigar and Cigarette Factory, and the Compañía General de Tabacos de Filipinas, whose cigarette machines were shown in operation, together with fine exhibits of cigars.

Entering the main building, the exhibit of H. R. Cooper & Co. was seen on the left, showing a locomotive with a complete assortment of track material, hot-air engines in operation, kerosene engines and woodworking machinery. Opposite was shown the exhibit of Fred Wilson & Co. consisting of a fine assortment of rice machinery, a portable engine and boiler of a late improved English type, transmission machinery, etc.

The southeastern portion of the building was completely filled

with the extensive exhibit of the Pacific Commercial Company, in which were seen several large irrigating pumps in full operation throwing huge volumes of water, a sawmill, concrete mixer, rock crusher, kerosene engines, ice machine, electric machinery, portable engine and boiler, hydraulic rams, traction plowing engine, an assortment of plows especially adapted for Philippine soils, saws, etc.

In the center of the building an artistic booth was erected by the Manila Electric Light and Power Company, filled with a large assortment of electric household and shop devices. A miniature electric locomotive ran around the upper part of the booth attracting great interest, especially among the children.

The northwestern portion was occupied by Germann & Co. Here was seen an internal-combustion engine of 15 horsepower direct connected to a generator, and a producer-gas engine of 75 horsepower. Interest centers in this latter engine as it forms a part of an installation to be placed in the Bureau of Science for the utilization of native coals by the producer-gas process. A beautiful effect was produced by an electric waterfall from current supplied by a generator forming a part of their exhibit. Woodworking machinery, electric fixtures, a rice thresher, and a portable engine were also exhibited.

Adjoining was the exhibit of C. E. Helvie, the striking feature of which was a large road roller. A hand fire pumping apparatus was also exhibited, and an assortment of late novelties for use on automobiles.

Next was shown the exhibit of the Brown Municipal Road Company, consisting of an improved road roller to be drawn by animal power, and a water cart.

The remaining portion of the building, the northeast corner, was filled with the exhibit of Frank L. Strong. Here were shown electric motors and generators, a steam engine, ice plant, blowers, woodworking machinery, marine and stationary kerosene engines, steam pumps, diving apparatus, pneumatic tools, an attractive display of saws and household electrical equipments. Great interest was shown in a large ball suspended in the air by the blast from one of the fans exhibited, and there were many speculations as to its cause.

In the north wing was placed the exhibit of the Milton E. Springer Company, consisting of saws, oils, and shelf hardware. A fine display of saws and tools was made by John Simmonds & Co. The remaining space was filled by the Bureau of Navigation with the most remarkable display of lighthouse apparatus ever witnessed in the Islands. Here was seen a first-order light of enormous proportions and very great cost, revolving as when

in actual use, throwing its powerful beams in every direction. Other lesser lights were also shown in operation, illustrating the colored and flash features.

The very great progress in lighting the Islands was graphically illustrated by a very large map on which were placed minute electric bulbs in the exact position of every lighthouse in the Archipelago, over 100 being so shown. Models of the new breakwater and piers were exhibited.

The Vacuum Oil Company, while making no special exhibit, furnished without charge oils for practically all the machines in operation in the building.

Outside the building was shown a copra dryer installed by Z. K. Miller, machinery expert of the Bureau of Agriculture, a timely invention and one from which much benefit should be derived in this most important industry.

This first real machinery exhibit in the Islands, large and varied as it was, represents but a small fraction of the machinery carried in stock by Manila dealers. There is no more hopeful sign of a people's progress than the extensive purchase of machinery, and this varied assortment shown at the Exposition illustrated the astonishing advances made by the Filipino people in material things during the few brief years of American occupancy. The froth and foam of politics are surface indications only and too often misleading, but underneath is found what really constitutes national welfare.

The Exposition was a great object lesson; we have seen the machinery, even though it be but a small portion of the many varieties sold in the Islands; what are the results? We need go but a few steps to another building to see one of the many. Here are the exhibits of the various trade schools in which are shown furniture and other manufactures made by the native youths from the beautiful woods of the country. Does it seem possible that in so short a time untrained boys can become so proficient in the use of machinery as to produce such exquisite bits of work? These are not merely of graceful proportions and perfect polish but a close inspection shows every joint perfect, squares that are square and rounds that are round, work that will pass the inspection of experts in the trade in any country. And this is but one of many trades these young men are learning, as for example, the most excellent samples of metal work shown.

A steady and ever increasing stream of machinery is entering the Philippines, and the bountiful products of nature are being prepared for man's use. The effect is already apparent and the future will show the most far-reaching results.

THE COMMERCIAL EXHIBITS, FIRST PHILIPPINE EXPOSITION.

Arrangements had been made for a complete article on the commercial exhibits at the 1912 Exposition; however, as this article has not come to hand in time to forward to the printer with the remainder of the manuscript for the April number, the description of these exhibits will have to be confined to a simple enumeration of the names of exhibitors together with the articles presented, as follows:

E. C. McCullough & Co., Michell and other makes of automobiles; Moll & Co., Emblem bicycle and other lines; The San Francisco, large display of Regal shoes; I. Beck, Victor talking machines and a line of general goods; Estrella Auto Palace, Brasier & Delahaye automobile; Alfredo Roensch & Co., full line of sporting goods; G. T. Nepomuceno, the sculptor, with a fine display; the British American Bible Society, with a full line of their publications; E. C. McCullough & Co., electrical supplies; The United States Shoe Company, a large display of Hike shoes; C. Pardo de Tavera, Clement Bayard bicycles and other goods; James Kelly & Co., Singer cycles; F. H. Thompson, general display of bicycles, electrical batteries, and general engineering supplies; Ateneo Rizal, art exhibit; American Hardware and Plumbing Company, Cadillac and Gramm automobiles and Badger hand chemical fire engines; Cadwallader-Gibson & Co., beautiful display of furniture manufactured locally from Philippine woods; M. & R. Herrman, comestibles and general lines; Nestle and Anglo Swiss Milk Co., general lines; Manila Art Studio, art display; Erlanger & Galinger, National cash registers, Indian motorcycles, talking machines and adding machines; Eureka Paint Company, excellent display of Black Diamond brand paint.

THE 1912 CARNIVAL.

Had Manila required a vindication of the Carnival idea, had any further proof been necessary than that offered by preceding Carnivals of the value of an annual event such as the original Carnival idea has been developed into, the fifth Carnival which is still fresh in the memory of half the Far East offered that vindication and proof, and showed in a thousand and one ways that the annual "fiesta" has established itself as a Far Eastern institution.

In years past the Carnival and Exposition have been connected, financially and in spirit. The Exposition of 1912, in magnitude easily the biggest thing of its kind ever attempted in the Far East, was planned on too large a scale to permit of its being incorporated with the Carnival, which resulted in their being conducted separately, yet inseparably joined in the larger sense that they both were designed and executed to further the doctrine of Philippines prosperity.

The separation of the Carnival and Exposition resulted in both being benefitted, in that it relieved the Carnival association of the burden of expense which the Exposition has annually called for, and left its organization free to devise and carry into execution a program of combined seriousness and frivolity which will be long remembered by the thousands who witnessed and took part in it.

The directors of the Carnival of 1912 went about their business in a business-like way. A "funny man" with years of experience in carnival and exposition affairs in the United States was brought to Manila to take over the responsibility of furnishing the means by which Manila might forget its troubles and go on a week's spree. He furnished them. "Loco Lane," as the avenue of fun was named, stood for one week as a monument to his ingenuity—then was torn down. The memory of it lingers, however, and the part played by Loco Lane in developing an entirely new Carnival spirit will long remain an asset of the association.

Carnival spirits of the past have glimmered in a shadow of

uncertainty and doubt. The American idea of losing one's dignity and mixing with a care-free abandon equaled only by the Frenchman was not appreciated by the Spaniard and Filipino, who hesitated and looked askance upon those of their number who did throw dignity to the winds. This year an entirely different atmosphere pervaded everything connected with the Carnival. Whether it was throwing confetti on Loco Lane or working up enthusiasm to a fever heat over the events and spectacles which formed the less frivolous side of the Carnival, Spaniards and Filipinos joined hands with a hearty good will and the result was a most conclusive demonstration of the birth of a new spirit which came forth in the full light of day and contributed everything to the success of the Carnival. It is to this new Carnival spirit that the builders of the 1913 show must and will look for whatever meed of success they attain.

Athletics, to which the younger generation of Filipinos look for the physical regeneration of their race, played the part in the 1912 Carnival that its importance to the Islands deserved. An athletic field in the center of the Stadium, surrounded by a quarter mile cinder track, was the scene of contests in baseball, basket ball, soccer, and field and track events between amateur organizations of the Islands which kindled in contestants and spectators alike that fire of enthusiasm and spirit of rivalry which has made other countries, as it will make this one, better and stronger, and keener of wit. The crack Waseda University team of Tokyo was brought to Manila for the Carnival, and was taken into camp by some of the local amateur organizations. Teams of all descriptions, baseball, basket ball, track and field, came from all parts of the Islands to participate in the Carnival sports, some of which were held independently and others under the auspices of the Philippine Amateur Athletic Federation.

From the Stadium also took place the aëroplane flights, which occurred daily. Thousands upon thousands of people whose knowledge of aërial navigation was limited to magazine pages had their first glimpse of an aëroplane in flight, and incidentally witnessed flying under the most trying conditions possible to impose upon an aviator, as high winds added to the natural dangers of rising from and alighting on a circumscribed area. Combined with the athletic events, the aëroplane flights packed the Stadium to its capacity every afternoon.

Too much can not possibly be said of the enthusiasm of the Filipino and Spanish committees who worked long and faithfully to make their festivals such splendid spectacles. To them is due no small part of the success of the Carnival, while to those

who participated in them, already repaid for their trouble and expense by the knowledge of having contributed their individual efforts to events which far surpassed anything of similar nature ever consummated in Manila, is also due great praise.

Viewed from the cold-blooded angle of business, and answering the question "Is it worth while?," the fact that practically every business man in Manila acknowledges the benefits of the Carnival and is willing to enter more fully into the next one, is eloquent.

Financially the association finds itself in better shape this year than ever before, with all its obligations discharged, and a sufficient working capital for the ensuing year to insure an even greater show for 1913. The exact figures are not available, or a statement of the year's work would be published as a part of this article.

Without any desire to make the foregoing modest account of the success of the Carnival of 1912 a tribute to its makers, the writer feels that in spite of his knowledge of their wishes to the contrary, the gentlemen who so loyally devoted their brains and time to making the 1912 Carnival the biggest success in the history of the association should receive at least a word of appreciation, and in expressing his thanks for their efforts, he feels that he is voicing the sentiment of all those who enjoyed any part of the "annual brain dusting."

THE MANILA HORSE SHOW, JANUARY 19, 20, AND 21, 1912.

By JOHN T. MACLEOD.

It is just a little over five years ago that a few public spirited and "true blue" sportsmen got together and organized the Manila Horse Show Association. With nothing in the treasury beyond the membership entrance fees, they boldly launched the first annual show in 1908, relying for prizes almost entirely on donations. Members of the association, enterprising firms, and several of the local clubs responded readily by the presentation of handsome cups, and the show proved a thorough success, coming as an agreeable surprise to the public, and reflecting the highest credit on the organizers. The patronage of an appreciative public, who cheerfully paid high prices for boxes and seats (and who felt satisfied afterwards that they had received full value therefor), left a balance of funds on hand to insure an even better result for the ensuing year; thus by careful management on the part of the indefatigable committee and the hearty support from the best class of patrons the show has gone on improving from year to year, until now it can vie with any of the high class shows in the homeland.

There is certainly no city in the Orient which can present such an attractive spectacle, and Manila may be justly proud of its annual horse show.

In the fifth annual show held in January there were horses from Virginia, Kentucky and California, France and Australia, mites of ponies from Java and Cochin China, and half- and full-bred native ponies from all parts of the Philippines—a number of varieties seldom, if ever, found together in any other part of the world—and not a poor-classed animal among them. Trotters were put through their paces at under 2.10 for the mile, and high jumpers reached within a shade of 1.83 meters. The turn-outs in buggies, dogcarts, phætons and victorias, in singles, tandems and pairs, caparisoned regardless of expense, would



THE FOUR-FOOT BRUSH JUMP WELL CLEARED.



A CREDITABLE TURNOUT OF OFFICERS' MOUNTS AND HACKS.



MR. JOSÉ GARCHITORENA'S WINNERS IN THE TANDEMS.



MISS HELEN HIGGINS' BEAUTIFUL TANDEM OF DIMINUTIVE
NATIVE PONIES.

compare favorably in quality and beauty of style with any in other parts of the world.

There were no less than 42 classes, divided as follows: 8 in the breeding, 14 in the saddle, 14 in the carriage, 4 in the special, and 2 in the children's classes. For these there were 78 cups and 7 cash prizes of a total value of about ₱7,000. Twenty-six of the cups were donated by clubs, firms, and individual members of the association.

The show was an unqualified success from both the utility and spectacular points of view.

Considering the excellent showing made by the Manila horse show association, it certainly has a just claim to some material support in the form of an annual subsidy. The main object of the annual show is to improve the breed of horses, and the country at large derives the benefit, so that it is neither fair nor just that the association should be entirely excluded from support by a small share of the public funds devoted to such purposes. The native full- and half-bred stallions and mares, and the imported stock presented in the breeding classes, gave evident proof of the great work being done in encouraging improved breeding in the Islands, and should alone justify the association's claim to a yearly subsidy.

With a substantial subsidy at its back, the usefulness of the association would be increased a hundredfold, and it requires no mathematical genius to calculate the immense material benefit to be derived by the country from every one per cent of improvement in the breed of its horses.

**PRINCIPAL PHILIPPINE IMPORTS AND EXPORTS—
JANUARY, 1912.**

By the INSULAR COLLECTOR OF CUSTOMS.

[Values in dollars United States currency.]

IMPORTS.

Articles.	Manila.	Cebu.	Iloilo.	Totals.
Rice.....	{Kilos. 22,876,243	2,367,890	2,290,538	27,534,671
	{Value 973,298	92,838	93,119	1,159,255
Beef cattle.....	{Number 2,728	198	226	3,152
	{Value 56,611	4,310	5,341	66,262
Sugar.....	{Kilos 300,014	8,275	21,500	329,789
	{Value 24,196	693	1,636	26,525
Coffee.....	{Kilos 126,544	555	447	127,546
	{Value 40,905	183	242	41,330
Cacao.....	{Kilos 142,288	9,178	129	151,595
	{Value 45,284	3,070	119	48,473
Eggs.....	{Dozens 455,184	166	150	455,500
	{Value 36,056	21	17	36,094
Raw cotton.....	{Kilos 52,660			52,660
	{Value 14,305			14,305

EXPORTS.

Hemp.....	{Kilos 11,458,793	2,879,772		14,338,565
	{Value 1,116,616	310,094		1,426,710
Sugar.....	{Kilos 2,054,220			2,054,220
	{Value 125,895			125,895
Copra.....	{Kilos 6,657,708	2,633,284	50,600	9,341,592
	{Value 624,793	257,717	4,400	886,910
Cigars.....	{Number 17,330,380			17,330,380
	{Value 245,232			245,232
Cigarettes.....	{Number 3,232,550			3,232,550
	{Value 3,004			3,004
Tobacco.....	{Kilos 2,227,321			2,227,321
	{Value 297,212			297,212

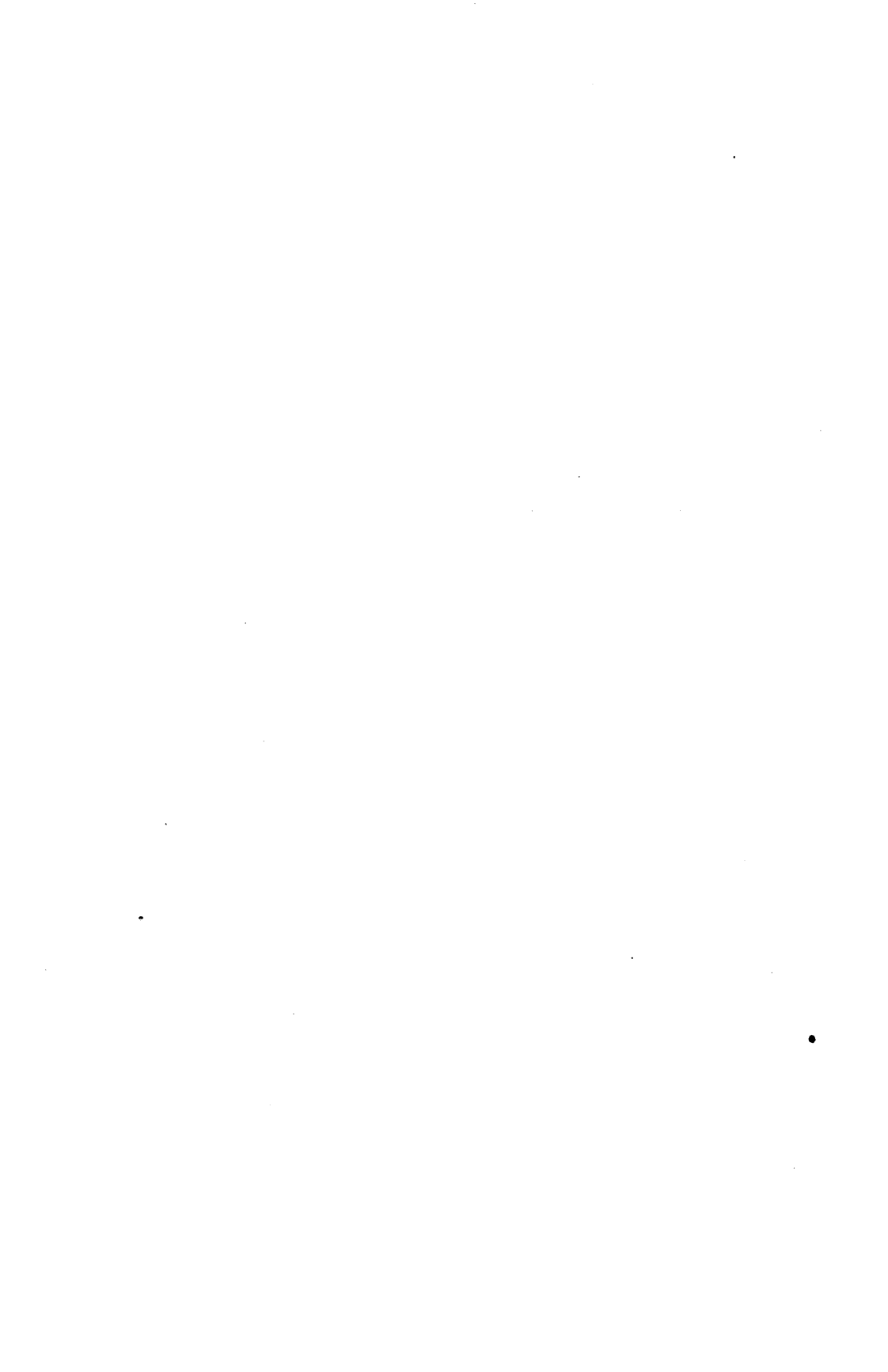
TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

By the DIRECTOR OF THE WEATHER BUREAU.

JANUARY, 1912.

[Temperature and total rainfall for twenty-four hours beginning at 6 a. m. each day.]

Date.	Hemp.				Sugar. Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.		Temper-ature.	Rain-fall.	Temper-ature.	Rain-fall.	Aparri.		San Fernando.	
	Temper-ature.	Rain-fall.	Temper-ature.	Rain-fall.					Temper-ature.	Rain-fall.	Temper-ature.	Rain-fall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1.	26.8		25.8		25.6		26.3		24.3		24.6	
2.	26.6	4.5	25.4	2.3	25.9		27.1		23.4	17.7	25.1	
3.	26.2	1.5	24.9	2.5	25.4	0.3	25.5		21.8	9.2	25.2	
4.	26	7.3	25	1	25.6	.5	26.5		22.6		27.4	
5.	25.8	2.6	26.1	2.8	25.9		26.8		24		25.4	
6.	26.1		25.6	13.7	26	1.3	26.2		23.4		25	
7.	25.5	.3	24.4	3.1	25.3		25.2		22.4	6.8	24.8	
8.	26.2	.8	24.4	6.4	25.1	1	25		21.7		25.2	
9.	26.6		24.5	4.5	25.5		24.8		21.9	3.1	26.4	
10.	25.8	1.8	24.3	2.3	25.8	.8	27.5	19.8	21.4	4	25.6	
11.	26.3	33	24.9	1.3	25.6	.8	27.2	2	22.5		26.2	
12.	25.4	11	24.4	48.4	26.2	2.8	26.2		22.8		25.8	
13.	25.4	.3	25.6		25.6	.5	27		23.3		26.4	
14.	26.2		25		25		26.4		24.3	1.3	25.6	
15.	26.4	1.3	25.6		25.2		26.2		24.2		26.8	
16.	26.6		25.2		25.4		26.2		24.4		26	
17.	26.1	1.3	25.2		25.6		26.8		24.8		27.2	
18.	26.2		25.7		25		26.2		24.3	1.3	25.9	
19.	26.6		25.4		24.9		26.8		23.4		25.8	
20.	25.6	1.1	25.2	1.8	25.2		25.4		25.4		26.2	
21.	25.9	.5	25		24.7		25.2		23.2		24.4	
22.	26		24.9	3.6	24.4		25.4		23.2		24.1	
23.	24.7		25.7		24.6		24.4		23.3		24.4	
24.	25.3		25.5		25.7		24.6		23.2		24.4	
25.	26.6		25.4		25.6		24.4		23.1		23.6	
26.	25.7	1	24.9	1.8	26		25.1		23.2		25	
27.	26.7		25.3		25.5		25.1		23.6	11.4	23.9	
28.	26.4		25.2	4.8	25.4		25.6		22.7	34.1	24.8	
29.	26.9		24.1	2	25.6		26.2		21	50.2	24.5	
30.	26.7	8.4	25.3		26		26.3	2	20	31.5	25.4	
31.	25.4	1.1	25		25.7		28		21.2	14.4	25	



MISSING PAGE(S)

FROM 242 TO 350



PLATE I.—IRRIGATED BANANA FIELD AT THE LAMAO EXPERIMENT STATION, BATAAN.

HORTICULTURAL NUMBER

THE PHILIPPINE *Agricultural Review*

VOL. V

JULY, 1912

No. 7

CONTENTS AND ILLUSTRATIONS.

CONTENTS.

	Page.
Editorial	352
The Present Status of Horticulture in the Philippines and Its Outlook for the Future, by P. J. Wester, Horticulturist.....	353
Annotated List of Philippine Fruits, by P. J. Wester, Horticulturist, and O. W. Barrett, Chief, Division of Experiment Stations.....	365
Annotated List of Philippine Vegetables, by P. J. Wester, and O. W. Barrett.....	371
The World's Widest-known Fruit, by O. W. Barrett.....	375
Marcottage: Its Utilization in the Tropics, by H. H. Boyle, Assistant Horticulturist.....	385
Recent Plant Introductions into the Philippines, by P. J. Wester.....	391
Bureau Station Reports for April.....	399
Current Notes—July: Possible Future Plant Introductions; Banana Collection; Banana Disease; A New Oil; Formosa, Our New Rival; The Stupendousness of Copra; Another Copra Dryer; New Copra Countries; Another New Food-preserving Method; Sago; Rubber and Buttons; Fertilizers; A Maize Bulletin; Agriculture not without Honor; Increasing Interest in Animal Industry in the Tropics.....	405
Principal Philippine Imports and Exports—April.....	413
Temperature and Rainfall for Agricultural Districts in the Philippines—April.....	414

ILLUSTRATIONS.

PLATE I. Irrigated Banana Field at the Lamao Experiment Station Bataan.....	Frontispiece.
	Facing page—
II. The Philippine Mandarin Lime, <i>Citrus nobilis</i> Lour.....	366
III. Types of Bananas; Fig. 1, "Tundoc" (<i>Musa paradisiaca</i> L.); Fig. 2. "Ni- lanzon" (<i>Musa</i> sp.).....	366
IV. Types of Vegetables. Fig. 1, Seguidilla (<i>Psophocarpus tetragonolobus</i> D C.); Fig. 2, "Native" Eggplant	372

TEXT FIGURES.

	Page.
Fig. 1. Methods of Binding the Wound for Marcottage in the Philippines.....	386
2. Root System Developed in Marcottage by Coconut-husk Method.....	387
3. a, Marcottage Method Employed in the Philippines; b, c, Marcottage Methods Employed in the United States and Europe.....	388
111163	351

EDITORIAL.

HORTICULTURE IN THE PHILIPPINES.

By the DIRECTOR OF AGRICULTURE.

In following out the plan adopted some time since of having every other number of the REVIEW devoted to some one subject, there has arisen such a wealth of material on many subjects that there is every indication that it will be necessary to have such special numbers occur even more frequently than had been at first planned. The present number was at first intended to include all of the phases of horticulture, but it has become necessary to hold over some of the material which will serve as a basis for a number devoted to trees and ornamental plants which may be used for planting in the Philippines. This number, therefore, is devoted to the fruits and vegetables exclusively.

There are few places in the world where may be grown in greater variety fruits which add so materially to the daily food supply. If every owner of even a small area of land would plant a few trees of some of the species described in this number, the results would be so satisfactory and the object lesson so good that the present comparatively meager supply of fruits in the Islands would be greatly increased. Land owners should bear in mind that it is usually possible to plant a few fruit trees without in any way interfering with the general cultivable area. The trees may be planted about the house and buildings and on the margins of land in such a way as to be not only useful but ornamental and at the same time provide without any additional expense a considerable supply of palatable and attractive food. Too little thought is usually given to the actual food value of fruit. Inhabitants of the Philippines think first of rice, and frequently second of the same crop when considering the food supply. The present prolonged drought emphasizes very strongly the desirability, and it might be said the necessity, of something in addition to rice which is not so subject to the ill effects from drought as are the ordinary farm crops. Nothing supplies this need so thoroughly as trees which root deeply enough to be in a considerable degree independent of the variation in water supply. It is for these reasons that the Bureau is continually urging through every possible channel the planting of fruit trees, and that fruits be considered as not only a desirable but a *necessary* portion of the food supply.

THE PRESENT STATUS OF HORTICULTURE IN THE PHILIPPINES AND ITS OUTLOOK FOR THE FUTURE.

By P. J. WESTER, *Horticulturist*.

Comparatively few years ago horticulture, even in countries where civilization is most highly developed, was considered to be an industry of subordinate importance in comparison with other industries such as agriculture, animal husbandry, mining, etc., and in many the word horticulture itself was a misnomer according to our present understanding of this term. It is scarcely astonishing then that horticulture, the most advanced stage in the cultivation of plants by man, is not farther advanced in the Philippines where certain folktribes are still uncivilized and where every stimulating influence in this direction has been absent until of late.

Since the American occupation of the Philippines, the interest in better horticultural products has grown, almost imperceptibly at first, but steadily, if slowly, as shown by the increasing volume of letters of inquiry and requests for seeds received by the Bureau, and by the better quality of many vegetables now offered in the Manila markets as compared with those of the early days. Mistakes and wasted efforts, which occurred in those times, have been corrected and the organization of the Bureau of Agriculture, now more closely than ever identified with the development of the plant industries of the Archipelago, has been strengthened and perfected. Seeds of improved varieties of vegetables have been imported and distributed in large quantities. So far nothing has been accomplished in the improvement of the vegetables that were already cultivated here before the insurrection against Spain, but since the organization of the present form of Government nearly all varieties of vegetables characteristic of the civilization of the Occident, not already brought here by the Spaniards, have been introduced, as well as better varieties of all. Perhaps the greatest single, or rather double, influence for the encouragement of the cultivation

of better vegetables for home use has been the large annual distribution of vegetable seeds by the Bureaus of Agriculture and Education, coupled with the recently-instituted school gardens of the Bureau of Education, which, rightly managed, should prove an immense force in developing horticulture in the Philippines. Notwithstanding these efforts in the past to elevate Philippine horticulture this science is, however, still in its infancy, and only a comparatively limited percentage of the total population have learned to appreciate the advantages of a home garden of more than a few native vegetables. The markets of the centers of population in the Philippines are not satisfactorily supplied with home-grown vegetables and fruits of good quality, and considerable quantities are imported from China and other countries, as may be seen from the figures quoted on another page.

Among the vegetables grown in the Philippines, there are a number of species of tropical origin, usually referred to as "native vegetables," for instance, the apalia, batao, seguidilla, pacupis, and gabi that are practically unknown to European and American horticulture; while the melon, squash, eggplant, camote, tomato, and many other vegetables introduced by the Spaniards, were grown in the Philippines before the advent of the Americans. The quality of most of the varieties of the latter class leaves much to be desired, however, partly perhaps on account of general ignorance of the importance of care in the selection and saving of seed among the population; in part the inferior quality is undoubtedly due to the deterioration in consequence of the climatic conditions in the Philippines. Some of the "native vegetables," such as the apalia, possess qualities, that, while relished by a people knowing them from childhood, make them repellent to the Caucasian and, in fact, are of little value; others, such as the gabi, camote, ube, seguidilla (see Plate IV) and libato are wholesome, nourishing and appetizing when they are properly prepared. The camote, cassava and ube are perhaps destined to play a greater rôle in the life of the people than any that may be yet introduced into the Philippines. As the population becomes better educated and begins to learn to discriminate, we may expect to see better varieties of all the "native vegetables" cultivated, and, together with those that have followed the civilization of the white race, in quantities to meet the demand of the home market; in addition there is every reason why some, like the camote, yam, and gabi, should also be grown for export.

There are very few fruits that are indigenous to the Philippines,¹ nearly all being introductions made by the Spaniards from other countries; a considerable number were probably introduced in prehistoric times by Hindu and Malay traders. As may be seen by a glance at the annotated list of Philippine fruits on another page, the number of fruits grown in the Archipelago is considerable, and it is therefore unfortunate that their cultivation is not more general; in fact certain species that are well distributed in some islands are not yet introduced into other parts of the Philippines; for example, such vigorous and easily grown trees as the mango, tamarind, chico, and lanzon.

Literally speaking, fruit *grows* in the Philippines; as yet one can scarcely say that it is *cultivated*, and fruit culture as a science or industry has yet to make its appearance in the Archipelago.

Excepting those planted to seedling mandarins in Batangas, only two regularly planted *fruit orchards* of pre-American origin—one of mango trees in Muntinlupa, Rizal, and another of ciruelas in Pulupandan, Occidental Negros—have been observed by the writer. Asexual propagation of fruit trees by the means of marcottage is practiced by the Filipinos to a limited extent, mainly in propagating the chico; the ciruela is propagated from cuttings, but all other fruit trees are nearly always grown from seed. Budding and grafting are practically unknown and the budded plants (citrus) hitherto set out in the Islands are limited to a few imported by either private experimenters, or this Bureau. The fruits discussed below are those most prominent at present and such as are believed to have a promising future at a not distant date, if handled properly.

The first among these is the cacao. There is scarcely room for doubt but that cocoa, or chocolate, is destined to become the world's greatest beverage. The world's consumption of cacao is increasing at many times a greater rate than that of either coffee or tea, and this in the face of rising prices, while coffee has been falling off somewhat in value. Some little idea of the important rôle cacao might play in the export trade of the Philippines if the cultivation of this plant were undertaken in earnest might be had when it is considered that the little island of Trinidad, during the fiscal year ending 1908, exported over 22,607,160 kilos of cacao valued at ₱17,863,860. In 1910, this had increased to over 30,500,000 kilos, while San Thomé, the

¹ See "Recent Plant Introductions into the Philippines," page 391.

small Portuguese colony on the west coast of Africa, exported more than 36,500,000 kilos. The world's consumption of cacao during the same year was in round figures over 194,000,000 kilos.

The cacao was long ago introduced into the Philippines, and the plant is found in all provinces of the Islands, but its cultivation has never attained prominence as an industry, notwithstanding the fact that certain parts of the Islands are well adapted to its cultivation; as may be seen on another page the importation of cacao forms a very large item in the Philippine imports. The cacao plant is subject to many diseases and insect pests that are inimical to its growth and profitable cultivation; moreover, it requires "culture" of a somewhat higher order than either the abacá or the coconut in order to succeed well, and not until this is realized by both present and prospective cacao-growers will the industry prosper in the Philippines. Judiciously located and cultivated intelligently, cacao plantations should bring much wealth into the Philippines; in fact it may be confidently predicted that if the industry is properly fostered and developed the cacao will in time completely overshadow in value any other single horticultural product of the Philippines.

The cultivation of Arabian coffee (*Coffea arabica* L.) was once a very remunerative industry in certain districts of the Philippines, notably in Batangas; but since the entrance of the coffee blight (*Hemileia vastatrix*), some twenty-five years ago, coffee growing has dwindled into insignificance and coffee is now, as may be noted on another page, *imported* instead of *exported*. After the devastation of the coffee plantations in Java a search was made for a coffee resistant to the blight, and *Coffea liberica* and *Coffea robusta* were as a result of this search brought into prominence, although they are greatly inferior to the Arabian coffee. Both these species have been introduced into the Philippines with a view to reviving the coffee industry and are planted here and there locally in a very limited way. However, the cultivation of these species does not at present affect the importation of coffee from other countries nor judging from the present outlook is it likely to do so in the near future. Many parts of the Philippines are well adapted to the culture of coffee and when the long-sought-for blight-resistant coffee has been found, or rather *originated*, the Philippines may at least produce the coffee consumed at home and perhaps even become an exporter.

The banana, of which there are two if not more species of the genus *Musa*, including at least fifteen and probably more varieties grown in the Philippines for their fruits, is more generally cul-

tivated throughout the Archipelago than any other; cooked, fried or raw it forms a more important part in the diet of the people than any other fruit; none other figures more prominently in the market at all seasons than the banana. It is rather singular that the poorly flavored and least desirable varieties are cultivated in preference to the better kinds though some contend that the reason is that the poorer sorts are hardier. More judicious selection of the varieties grown together with better cultivation would greatly increase both the quality and the quantity of the fruit produced. The local markets are well supplied with bananas but there is ample room for expansion both for the production of fresh fruit for the home market and export, and for the growing of bananas for the manufacture of banana flour, wine, and evaporated fruits.

Citrus fruits.—While the many varieties of bananas are of far greater importance in the diet of the population than any other fruit, the mandarin is—with the exception of the mango—the only one that is exported. The mandarin is grown chiefly in Batangas, especially around the municipalities of Tanauan and Santo Tomás. Excellent mandarins have been obtained by the writer from Tarlac and the Cuyo Islands, while oranges from the latter place, Salasa, Pangasinan, and other points in Luzon, as well as pomelos, limes, and lemons of excellent quality have also been obtained from several provinces; the calamondin, even in its natural state, produces an “ade” fruit of no mean value, and is unexcelled in the form of marmalade. A preliminary study of the citrus fruits in the Archipelago has shown that the Islands possess an unusually great number of forms, some of which promise to become of considerable economic value. Among those are a type of lime known as “Limon Real,” of exceptionally good flavor and quality, also a mandarin lime of excellent flavor that has a greater percentage of juice than any citrus fruit that has come to the writer’s attention. (See Plate II.) What appears to be a natural hybrid between the tangerine and the orange has also been found. Aside from these, what seems to be three new or imperfectly known species have been found in the Visayas which although inedible may prove to be of value as stocks or for other purposes. Considering the care they receive, the citrus trees throughout the Archipelago are remarkably healthy, and thrifty, and free from injurious scale insects.

During recent years, several varieties of oranges, pomelos, and lemons have been introduced by the Bureau of Agriculture and

private experimenters interested in citrus culture, but it is yet too early to form a correct estimate in regard to the value of these introductions. The success that has attended the introduction of modern methods of cultivation of the citrus fruits in Porto Rico and other parts of the West Indies having a climate essentially like that of the Philippines would seem to indicate that, considering that even now without any culture whatsoever, the Philippines already produce citrus fruits of no mean quality, the Islands could, with better methods of culture, produce very superior citrus fruit. While our production of citrus fruits may not even approach the figures quoted below, it may not be amiss to state that Spain annually exports 40,000 carloads of oranges, Italy 20,000 carloads of lemons, and that the annual production of oranges in Florida exceeds 5,000,000 boxes, the value of which may be estimated at ₱10,000,000.

In Nueva Ecija, Cavite, Cebu, Pangasinan, Bulacan, Bohol and Zambales are located the principal mango-growing districts in the Philippines, but the tree is found to more or less extent in all provinces of the Archipelago. However, not even in the mango-growing centers, is the mango planted as an orchard tree, but rather along the edges of the rice and corn fields, on the roadsides or on hills too steep for the cultivation of field crops.

Soil and climatic conditions are favorable for the growth of the mango everywhere in the Archipelago, but the yield of fruit is small compared to the size and number of the trees. This is undoubtedly due partly to an excess of nitrogen in the soil and lack of culture, and could probably be corrected by applications of potash and phosphoric acid and proper cultivation; it is partly caused by the presence of two species of homoptera, *Idiocerus niveosparsus* Leth. and *Idiocerus clypealis* Leth. which attack the flowers of the mango, two Lepidopterous larvae also destructive to the flower, and a fruit-fly, which attacks the fruit. However, the greatest reason for the sterility of the mango is the fact that the trees are seedlings, and, were they budded, it is believed that the crop might be more than doubled without increasing the acreage, not speaking of other resulting advantages, for instance, such as the production of any desired variety, the control of the fruiting season by budding into late or early varieties, and the dwarfing of the tree to facilitate the gathering of the fruit and the combating of insect enemies and diseases—not of inconsiderable importance in a vigorous and large growing tree like the mango. The Carabao, Pico, and Pahutan are the

three forms most generally grown, and important in the order enumerated; others like the "Señora," "Señora cabayo," and "Pahut" are local and unimportant.

Next to the banana, the papaya is perhaps the most generally grown fruit in the Philippines, but nearly all belong to a dioecious, degenerate type, producing small, seedy fruits of poor flavor, of which, moreover, a very large percentage are staminate and consequently unproductive. Another bisexual type with large, well-flavored fruits, known in various parts of the Islands as Hawaiian, Dapitan, or Singapore papaya, after the name of the place from which they were introduced, is gradually displacing the other kind. Considering its few cultural requirements, the ease with which it is cultivated, and the rapidity with which it grows, producing ripe fruits in less than twelve months from the sowing of the seed, the impression might obtain that good papaya fruits are abundant, but nothing could be more erroneous, and this notwithstanding the fact that the papaya is one of the fruits in the Philippines that the white resident invariably takes to and for which he is willing to pay a good price and for which there is a good demand that so far has never been supplied.

The pineapple is at present grown chiefly for its fiber, and the fruit is mostly considered as a by-product. Wherever the pineapple has been seen by the writer, and it seems to be introduced in most places in the Islands, it grows well and appears to be exempt from serious insect pests and diseases; still it is grown to a slight extent only. The latest statistics available (1903) place Samar in the lead with an area of 51 hectares in cultivation, Occidental Negros and Tayabas with 41 hectares each, Bulacan 31, and Bataan 30 hectares. Other provinces mentioned with an annual production of more than 20,000 fruits are Leyte, Cebu, Cagayan and Zambales. The pineapples sold in Manila during the pineapple season are grown in Bataan but scarcely in sufficient quantities to supply the demand, while during the greater part of the year there are no pineapples whatever in the market. The varieties grown at present are well flavored, but have a too excessively large crown, with the eyes too deepset, subject to "eyeroot," and the slips too near the base—in fact, frequently attached to the fruit itself—for good market sorts, and being frequently slender, small and tapering, they are likewise unsuitable for canning purposes; not until other varieties have been introduced may we expect to see a pineapple industry come into existence, notwithstanding a climate and soil eminently suited to pineapple culture in many parts of the

Archipelago. Two companies have recently engaged in pineapple growing and it can not be doubted but that with the introduction of better varieties and modern methods of cultivation pineapple culture before many years will become a very important horticultural industry in the Archipelago.

The chico is at present a far more important fruit in the markets than the pineapple, and it may be obtained in every month of the year. The fruit is small, but of remarkably uniformly good flavor and quality. The chico is too sweet for preserving, but it makes an excellent dessert fruit. Few tropical fruits are so indifferent to careless handling as the chico and we may in the near future see it exported in increasing quantities to the nearby Asiatic ports and together with other fruits replenish the supplies of the passenger and freight steamers that call at Manila.

It is in the anticipation of the future rather than on account of the rôle it plays at present in the life of the Filipinos that the seedless breadfruit is here included. The unimproved seedy forms are quite well distributed in the Islands, though they occur very sparingly in certain districts. The seedless variety is seldom found and the fruit is but rarely offered in the market. This is very naturally due to the fact that, being seedless, it is only with difficulty propagated. The breadfruit, as far as has been noted by the writer, appears to be immune to diseases and injurious insects and when an easy and convenient way of propagating the fruit vegetatively has been found, the breadfruit may be expected to rank as one of the leading fruits in the Philippines—not to forget that a large number of varieties are still waiting to be introduced from the Islands of Polynesia.

The avocado, so much esteemed in the American tropics, was introduced into the Philippines by the Spaniards, but for some reason the introduction of this tree did not become permanent, and the few trees that were planted by the Spaniards died—the last one, growing in the plaza west of the Delmonico Hotel, Manila, blew down in a baguio a few years ago—without having produced seed for the propagation of their kind. The avocado was again introduced in 1903 from Hawaii by the then horticulturist of the Bureau, Mr. W. S. Lyon. A number of plants were distributed to fruit growers in the Islands, but the bulk of trees obtained from these importations were planted at the Lamao agricultural experiment station, Lamao, Bataan. Some of the trees have fruited, but the fruit produced is rather inferior as

compared with the best sorts grown in Florida. However, the trees have made a very satisfactory growth, and when superior varieties shall have been introduced, the avocado, on account of its food value, will unquestionably in time rank as one of the most important fruits here.

Of all the plants introduced into the Philippines by the Spaniards no species has been so well disseminated as the guava; in fact, it has long ago become naturalized, due to the dispersal of the seeds by birds which eat the fruit. The products made of the guava, jelly, "cheese" and canned fruit, are unexcelled in flavor and aroma, and a preserving industry for the manufacture of jelly and cheese is gradually growing up in Cuba and South Florida, the canning of the fruit being retarded because of lack of large, fleshy fruits with few seeds, adapted for canning purposes. While of course better varieties with large fruits are desirable for the production of fruit for preserving factories on an extensive scale, the varieties now growing in the Islands yield a fruit from which a first-class jelly and cheese can be made, and any one looking for opportunities in this direction will find the guava the most promising for immediate use of all the fruits grown at present in the Philippines, and of which there can be obtained a comparatively large supply of raw material.

While these are the most prominent of the fruits grown in the Philippines, there are many other more or less important fruits in the local markets all of which are included in the "Annotated List of Philippine Fruits" on another page.

Having reviewed the situation in the past and present and discussed the more prominent fruits and their possibilities, let us now turn to the statistics for the past year and see the actual loss in cash to the Philippines, owing to the neglect of horticulture.

The value of the total imports during the fiscal year ending June 30, 1911, was ₱99,667,444. During this period the following horticultural products were imported:

Cacao	₱523,870
Coffee	510,078
Fruits (fresh, canned and dried).....	483,372
Nuts	172,260
Vegetables (fresh and canned, including beans and peas)	<u>1,409,610</u>
Total	3,099,190

This is a greater amount than any other single item imported excepting cotton, ₱20,610,034; rice, ₱13,121,260, and meat and dairy products, ₱5,800,056, and represents about 3 per cent of the total value of all imports into the Philippines; with a population of eight million souls this is a yearly tax of over ₱0.38 on every inhabitant in the Archipelago, including women and children.

The above is relative to our home markets. How badly our nearest export markets have been neglected may be surmised from the fact that during the same period, fruits and nuts to the value of only ₱182 were exported to China, ₱40 to the British East Indies, ₱19,760 to Hongkong, ₱4 to Japan and ₱8 to Australia. The total horticultural exports during the year amounted to ₱48,106. There is no doubt but that Hongkong could readily absorb fruit up to many times the amount that is being sent there, and that much fruit could be exported to China and Japan. Cochin China, like the Philippines, does not supply its own home markets, but imports yearly citrus fruits from foreign countries. Here as in other neighboring countries where the fruit industry is undeveloped, lies the opportunity of the Philippine fruit grower.

Australia is not too far away to receive a considerable share of our horticultural exports and the following statistics from that country, our nearest market from which full statistics are obtainable relative to importation and exportation of the following horticultural products, should prove educating and full of interest.

Imports into Australia, 1910.

Arrowroot	₱36,490
Fruits, dried (other than dates, currants, raisins)....	192,690
Bananas	445,490
Citrus fruits	214,890
Pineapples	870
Preserved fruits and vegetables.....	472,200
Jams and jellies	88,590
Dried or concentrated vegetables.....	60,250
Cocoa products	3,152,070
Fruit juices and fruit sirups.....	95,240
Total	4,758,780

Exports from Australia, 1910.

Arrowroot	₱12,150
Dried fruits (other than dates, etc.).....	101,700
Bananas	560
Citrus fruits	247,510
Pineapples	39,850
Other fruits	274,770
Fruits and vegetables (preserved).....	151,540
Jams and jellies	283,720
Cocoa products	23,730
Fruit juices and sirups.....	16,200
Total	1,151,730

There is accordingly a trade deficit of over ₱3,600,000 in the products referred to which are supplied by foreign countries, the most important by far of these being cacao.

Some of these products, well adapted to the Philippines, as for instance arrowroot, are shipped to Australia from the far-away West Indies, and Australia receives citrus fruits from the Mediterranean countries and California. How well Australia has fostered her horticultural interests is illustrated in the above statistics and should make the Philippines, with her equal and in many respects superior advantages, blush with shame for her neglected opportunities and stimulate her into organized effort to take her just share of the world's trade in the products that are under discussion. It may not be inopportune to quote here the imports into the Philippines from Australia during the fiscal year ending June, 1911.

Citrus fruits	₱4,000
Other fresh fruits (except apples).....	5,800
Dried fruit	5,740
Jam and jellies	9,860
Total	25,400

This is not a large amount in itself; it is in comparison with Philippine horticultural exports to Australia (₱8) that it looms large.

Owing to the long distance to our principal large markets and the perishable nature of most of the fruits cultivated in the Philippines, we can hope to export but few kinds of fresh fruits. However, with proper handling we should have but little trouble in placing oranges, mandarins and pomelos in the principal markets of Australia and perhaps bananas and mangos. Owing to our geographical situation with consequent

ripening of the fruit at a different season than the same fruits in Australia, these fruits would not compete with the home-grown fruit in that country, and it seems reasonable to believe that with our superior soil and cheaper labor as well as being much nearer to the Australian ports, we may expect to successfully compete with Spain, Italy and California for the citrus fruit trade of Australia.

The production of fresh fruit for export should be a considerable item; however, the manufactured products—fruit, canned and dried, crushed and grated, made into jams, jellies, and marmalade, fruit sirups, flavoring extracts, and wine—is the one item that is destined to be of primary importance. In this form the Philippine fruits may find their way not only to our nearby markets, but to those in the Americas and Europe. At present most of the fruit preserves used in the Tropics come from the Temperate Zone but there is no good reason why the Tropics should not at least send an equivalent of preserved tropical fruits in exchange for those received from the Temperate Zones. Hawaii has within the last few years shown what may be accomplished in this line in growing and canning pineapples, and with an even better soil and an equally good climate, the Philippines may well not only imitate her sister Archipelago, but may well make pineapple growing and canning the nucleus of a preserving industry that will expand until it includes all the tropical fruits grown in the Archipelago that may thus be utilized.

Fruits and vegetables are the two great horticultural products, but there is a third, spices, the production of which in some countries yields great profits to the planters. Some of the spices, such as black pepper, ginger, and cinnamon, have been introduced, but their cultivation has never become of any importance; yet the first-named grows practically wild in certain places. Ginger alone is grown to any extent but yet not enough for home consumption. Part of the Philippines possess ideal climatic conditions for the cultivation of vanilla, yet no one has attempted its culture here; this is also true of the nutmeg and cardamon. With the introduction of good varieties, with dangerous fungi and insect pests excluded, with a better knowledge of modern methods of culture on the part of the people, and with coöperation on the part of the Government, there is reason to believe that the growing of spices may yet take high rank among the horticultural crops of the Philippines.

ANNOTATED LIST OF PHILIPPINE FRUITS.

By

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AND

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1. Alubihod, *Spondias mangifera* Wall., a tree related to the mango, bearing yellow fruits of the size of a small plum, indigenous to the Philippines; rarely cultivated.

2. Alupag, *Euphoria cinerea* Radlk. Indigenous to the Philippines and widely distributed. The fruit is similar to the litchi, but smaller.

3. Banana, *Musa* spp. The banana is the most universally cultivated fruit in the Philippines and occurs in a greater number of varieties than any other fruit in the Islands. The following varieties are more or less common and important in the order of their enumeration: Lacatan, Latundan, Sabá, Gloria, Bungulan, Butúan, Matabia, Lacatan Morado, Daliring Señora, Ni-lanzon, Tundoc, Chinese Dwarf. Specimens of a very interesting form called *Dominus vobiscum* has also been noted by the writers, but it is doubtful whether this is a constant variety or merely an anomalous form of Sabá.

4. Biasong, *Citrus* sp. A small, oblong, pyriform, very distinct fruit from others of the same genus, found in Cebu.

5. Bignay, *Antidesma bunius* Spreng. A small ornamental tree, occurring in all parts of the Philippines; the small dark-red sub-acid fruits are produced on long racemes like the red currant.

6. Bitungol, *Flacourtia sepiaria* Roxb. A small shrub, seldom cultivated, having small, purplish, sweet fruits.

7. Bobog, *Sterculia foetida* L. A medium-sized deciduous tree, indigenous to the Philippines, and seldom cultivated; the large seeds have a pleasant nutty flavor and are eaten.

8. Breadfruit, *Artocarpus communis* L., of which there are three forms, one perhaps a separate species. The seedy types occur in most municipalities but the seedless variety is very rarely grown, and is found chiefly around Manila and in Pangasinan.

9. Cabuyao, *Citrus hystrix* D C. This tree is found in most municipalities, although usually in few numbers in each municipality; there are several varieties.

10. Cacao, *Theobroma cacao* L. The Forastero type is well disseminated throughout the Archipelago but cacao culture has nowhere assumed much importance.

11. Calamondin, *Citrus mitis* Blanco, is quite generally distributed and the fruit may be found in the municipal markets throughout the year.

12. Camanchile, *Pithecolobium dulce* Benth. Of general distribution in the more accessible provinces of Luzon and to some extent in the other parts of the Archipelago.

13. Camia, *Averrhoa bilimbi* L. Well distributed in most parts of the Philippines and more commonly cultivated than the nearly-related carambola.

14. Carambola, *Averrhoa carambola* L., of which there are two varieties, is of limited and local cultivation.

15. Cashew, *Anacardium occidentale* L. Fairly well disseminated, but grown to a limited extent only.

16. Catmon, *Dillenia philippinensis* Rolfe. A tree indigenous to the Philippines having large green acid fruits.

17. Cereza, *Muntingia calabura* L. Well introduced in the more accessible provinces of Luzon.

18. Chico, *Achras sapota* L. The chico is fairly generally distributed and one of the principal fruits in the Manila market.

19. Chico-mamey, *Lucuma mammosa* Gaertn. The culture of this fruit is confined chiefly to Laguna and Cavite.

20. Ciruela, *Spondias purpurea* L. One of the most popular fruits in the Philippines, notwithstanding its large seed in proportion to the flesh.

21. Citron, *Citrus medica* L. Rarely found except in the gardens of hacenderos.

22. Coconut, *Cocos nucifera* L. About ten varieties are found here, all but two being more or less localized. Though the most important fruit, or nut, commercially, it does not enter into the diet of the Philippine people to a very great extent; they consume considerable quantities of the oil, and a little of the "meat" but seldom drink the "milk."

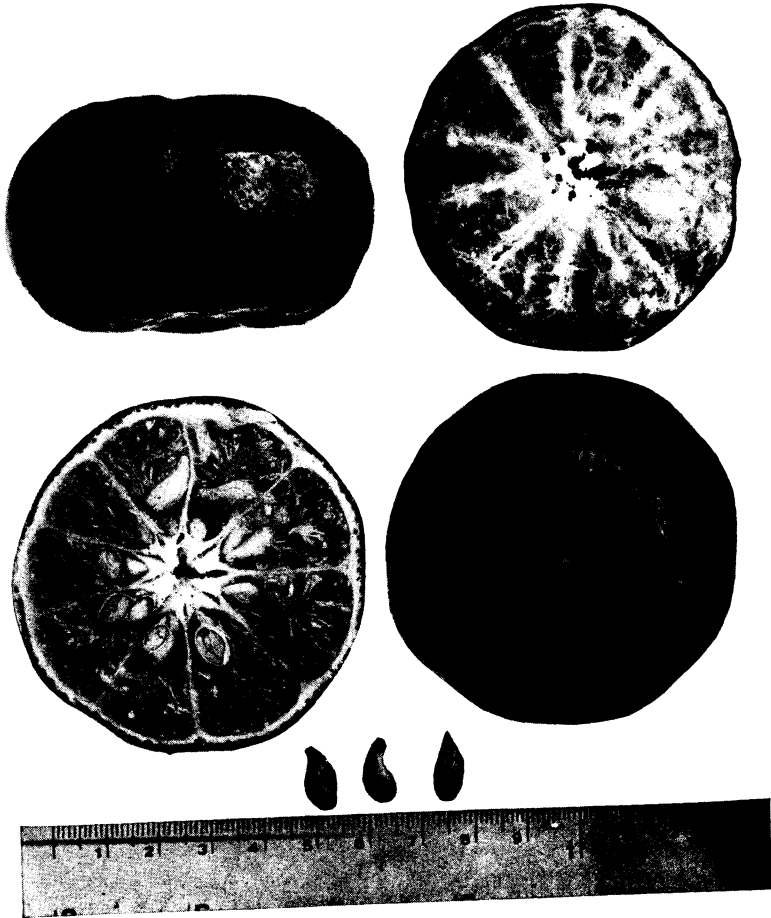


PLATE II.—THE PHILIPPINE MANDARIN LIME (*Citrus nobilis* Lour.).



FIG. 1.—Tundoc (*Musa paradisiaca* L.).

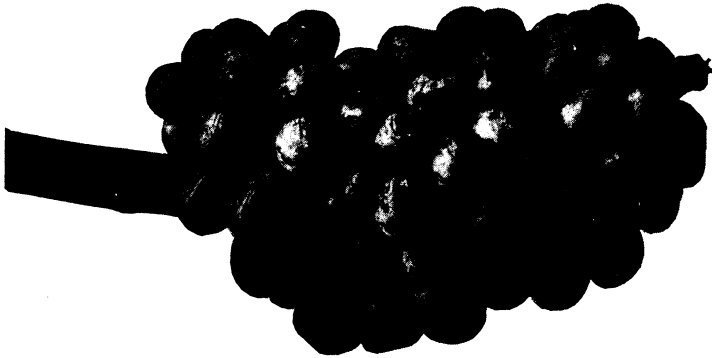
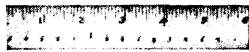


FIG. 2.—“Ni-lanzon” (*Musa* sp.).

PLATE III.—TYPES OF BANANAS.

23. Coffee, *Coffea arabica* L., has been introduced almost everywhere, but since the appearance of the coffee blight, *Hemileia vastatrix*, its cultivation has become of little importance. *Coffea liberica* and *Coffea robusta* have been introduced, but are grown only locally.

24. Colo, *Citrus* sp. A rather large, pyriform fruit occurring in Cebu.

25. Custardapple, *Anona reticulata* L. Found quite generally in Central Luzon as far north as Pangasinan and south in Rizal, Cavite and Batangas, more sparsely in Visayas; less esteemed than either the sugarcapple or the soursop.

26. Date, *Phoenix dactylifera* L. Noted at Iloilo only; so far as known the date has never fruited in the Philippines.

27. Duhat, *Eugenia jambolana* Lam. Very generally disseminated and considerable quantities of the fruit are marketed during its season of maturity.

28. Durian, *Durio zibethinus* Lam. Confined to the Sulu Archipelago and Mindanao.

29. Fig, *Ficus carica* L. Of rare occurrence; does not succeed well.

30. Granadilla, *Passiflora quadrangularis* L. A climber related to the papaya; of limited and local cultivation.

31. Grape, *Vitis vinifera* L. The grape was introduced by the Spaniards and is cultivated principally in Cebu; vines are also found to a very limited extent in Manila, also in Bataan and other provinces.

32. Guava, *Psidium guajava* L. One of the most generally grown fruits in the Philippines, although at present neglected and of little commercial importance.

33. Iba, *Phyllanthus distichus* Muell., occurs sparingly in the more settled provinces of Luzon.

34. Igot, *Eugenia* sp. A small tree, bearing a red cherry-like sub-acid fruit of good flavor, sparsely cultivated in the Visayas; unknown in Luzon.

35. Jak, *Artocarpus integrifolia* L. One of the most widely disseminated and cultivated fruits in the Archipelago.

36. Kaki, *Diospyros kaki* L. Of local and very limited cultivation.

37. Lanzon, *Lansium domesticum* Jack. Not a fruit of general distribution; outside of Mindanao it is grown chiefly in Cebú and Laguna.

38. Lemon, *Citrus limonum* Risso. The lemon is grown to

less extent even than the lime; in fact, it scarcely ever appears in the market; three very distinct varieties occur.

39. Lime, *Citrus limetta* Risso. The lime occurs in several varieties; the best of these is the "limon real," a rather large oblatly flattened fruit, the better seedling trees of which produce a very superior fruit. The species is of general distribution throughout the Philippines but is less in evidence than the pomelo, mandarin, orange, and calamondin.

40. Limoncito, *Triphasia aurantiola* Lour. Sparsely disseminated in Luzon and the Visayas.

41. Longan, *Euphoria longana* Lam. Introduced many years ago, but only a few trees are extant; these have not, as far as known, ever fruited.

42. Mabolo, *Diospyros discolor* Willd. Of general distribution throughout the Archipelago.

43. Macopa, *Eugenia javanica* L. Well distributed, particularly in the Visayas; the fruit is very ornamental, but dry and tasteless.

44. Macopa, *Eugenia malaccensis* L. A far better fruit than that of *E. javanica*. The tree, however, is not well distributed. Closely related to the preceding species.

45. Mandarin, *Citrus nobilis* Lour. The most generally cultivated species in the genus. It is fairly well disseminated throughout the Islands but Batangas is the only province where its cultivation has assumed any importance. Commercially the mandarin is the second most important fruit in the Philippines. A very interesting form of this species exists, the flesh of which is white, exceedingly juicy, pleasantly acid, and without a trace of sugar.

46. Mango, *Mangifera indica* L. The third most important fruit in the Philippines. The Carabao, Pico, and Pahutan (Paho in the Visayas) are the types important in the order named, and the ones in general cultivation. Local varieties of little importance are the Señora, Pahut, Señora cabayo, Cabuyo, Bulac, and Paho (distinct from that fruit in the Visayas). The Provinces of Cavite, Cebu, Bohol, Nueva Ecija, Pangasinan and Zambales lead in the production of mangos. In certain parts of the Visayas the mango is still scarce, or only poor varieties are cultivated.

47. Mangosteen, *Garcinia mangostana* L. Confined to Mindanao and the Sulu Islands.

48. Manzanita, *Zizyphus jujuba* L. Confined almost entirely to Luzon where it is of local and limited cultivation.

49. Mulberry, *Morus nigra* L. Introduced many years ago but of limited distribution only.

50. Orange, *Citrus aurantium* L. Fairly well distributed but of limited cultivation; grown principally in Batangas, Cuyo Islands and Pangasinan.

51. Pangi, *Pangium edule* Reinw. A tree producing a well-flavored, edible fruit. Confined to the Visayas. Not in cultivation.

52. Papaya, *Carica papaya* L. Next to the banana the most generally cultivated fruit in the Philippines. Three distinct types occur.

53. Pili. A name applied to two species, *Canarium ovatum* Engl. and *C. pacyphyllum* Perk., both native of the Visayas, the latter-named species occurring as far north as Tayabas in Luzon. Both species produce a nut of exceedingly good quality. Generally cultivated in coconut plantations. The husk is sometimes eaten.

54. Pineapple, *Ananas sativus* Schott. Of general distribution throughout the Islands but grown for its fiber rather than for its fruit.

55. Pomegranate, *Punica granatum*, L. The cultivation of this plant is local and limited.

56. Pomelo, *Citrus decumana* L. Found more evenly distributed in the Archipelago than any other species of the genus, it is, however, never grown extensively. Seedlings producing excellent fruit, some nearly seedless, have been found in several provinces.

57. Roselle, *Hibiscus sabdariffa* L. An annual, malvaceous herb, attaining a height of 1.5 to 2 meters, the leaves of which may be used as "greens," and together with the tender stems utilized in the manufacture of jelly, flavoring sirup, and wine. The full-grown fleshy calyces are also used in making a sauce as well as jelly, sirup, and wine. The most important recent introduction.

58. Samuyao, *Citrus* sp. A small, nearly round fruit, conspicuously dented at the apex, growing in Cebu. (See Philippine Agricultural Review, Vol. IV, No. 10, Plate III (a).)

59. Santol, *Sandoricum indicum* L. Widely distributed throughout the Philippines, but not extensively cultivated.

60. Soursop, *Anona muricata* L. Perhaps the most widely grown of all the Anonas in the Philippines.

61. Strawberry, *Fragaria vesca* L. The cultivation of the strawberry is chiefly confined to Benguet.

62. Sua, *Citrus* sp. An oblately-flattened citrus fruit grown in Cebu and other parts of the Visayas; possibly a variety of *Citrus medica* L. (See Plate II, Vol. IV, No. 10, Philippine Agricultural Review.)

63. Sugarapple, *Anona squamosa* L. A general favorite nearly everywhere north of the Visayas, but rare in the south except in Iloilo.

64. Tamarind, *Tamarindus indica* L. Well disseminated nearly everywhere in the Islands.

65. Yambo, *Eugenia jambos* L. The least common of all the Eugenias included in the list, though second in value only to the Duhat.

66. Zapote, *Diospyros ebenaster* Retz. Confined chiefly to the Island of Luzon; of local and limited cultivation.

ANNOTATED LIST OF PHILIPPINE VEGETABLES.

By

P. J. WESTER, *Horticulturist*,

AND

O. W. BARRETT,

Chief, Division of Experiment Stations.

1. Apalia, *Momordica balsamina* L. A cucurbitaceous vine of very general cultivation throughout the Archipelago, the fruit and tender foliage of which are eaten by the natives. On account of a bitter principle the plant contains it is unlikely to come into use by Caucasians.

2. Banana, *Musa* sp. The flowerbuds of the banana are extensively used as a vegetable in all parts of the Philippines.

3. Batao, *Dolichos lablab* L., of which there are several varieties, is a trailing or climbing legume of very general cultivation. The tender young pods are eaten.

4. Beet, *Beta vulgaris* Mog. Only slightly known, becoming generally cultivated.

5. Buting, *Phaseolus vulgaris* D C. Grown to a considerable extent, particularly in Luzon.

6. Cabbage, *Brassica oleracea* L. In fairly general cultivation; does particularly well in the mountain districts.

7. Cadyos, *Cajanus indicus* L. Several varieties of this plant are distributed fairly well in all provinces; the seeds are eaten like beans or peas.

8. Camote, *Ipomoea batatas* L. This is the most important of the root-crops in the Archipelago; the number of varieties found here at the beginning of the American occupation has been greatly added to by the introduction of many varieties from the United States and other countries.

9. Carrot, *Daucus carota* L. Grown to a limited extent only, but becoming generally cultivated.

10. Cassava, *Manihot utilissima* Pohl. The cassava plant is

found everywhere and is of considerable importance as a root-crop.

11. Celery, *Apium graveolens* L. Recently introduced from the United States. It is one of the few vegetables with which very little success has been made.

12. Chile, *Capsicum minimum* Roxb. Commonly found nearly everywhere in the Archipelago. *Capsicum annuum* L., also known under the same name, is cultivated to a limited extent only.

13. Coletis, *Amaranthus oleraceus* L. Commonly cultivated around Manila, rare in the provinces.

14. Condol, *Benincasa cerifera* Savi. A cucurbitaceous vine having a melon-like fruit. It is well distributed throughout the Philippines.

15. Cucumber, *Cucumis sativus* L., called pepino in the Philippines, is somewhat less extensively grown than the water melon; the quality of the native varieties is very good.

16. Eggplant, *Solanum melongena* L. Well distributed and one of the most important vegetables in the Philippines. The variety generally grown has long slender snake-like fruits of good quality.

17. Endive, *Cichorium endivia* L. Of recent introduction; the cultivation of this plant is rather restricted.

18. Gabi, *Colocasia antiquorum* Schott., of which there are several varieties, is extensively cultivated for its edible roots. Few of the white population in the Archipelago are aware that the better varieties of this plant make an excellent substitute for the potato. It grows best on moist rich lands and is easily cultivated. One of the most promising of the "native vegetables."

19. Garlic, *Allium sativum* L. Grown chiefly in Batangas and to some extent in the Visayas.

20. Lettuce, *Lactuca sativa* L., is in fairly general cultivation.

21. Libato, *Basella rubra* L. A trailing vine, the leaves of which are tender, succulent and make excellent "spinach." It is fairly well distributed throughout the Archipelago. The libato is an annual grown from seed and succeeds best in rich, moist but well drained land, and deserves far more attention than so far has been accorded this plant by both Filipinos and Caucasians.

22. Magtambocao, *Canavalia ensiformis* D C. Sparsely cultivated for its edible beans.

23. Malungai, *Moringa oleifera* Lam. A small tree very generally grown; the pods and leaves are utilized as a vegetable.

24. Melon, *Cucumis melo* L. Several varieties are cultivated



FIG. 1.—Seguidilla (*Psophocarpus tetragonolobus* D C.).



FIG. 2.—"Native" Eggplant.

PLATE IV.—TYPES OF VEGETABLES.

extensively; the quality of nearly all is, however, far inferior to melons grown in the Temperate Zone.

25. Mungo, *Phaseolus mungo* L., of which there are several varieties, is quite generally grown everywhere for its beans.

26. Mustard, *Brassica juncea* Coss. Cultivated to a limited extent only; becoming better known.

27. Okra, *Hibiscus esculentus* L., is in very general cultivation.

28. Onion, *Allium cepa* L. Cultivated principally in the Mountain Province; to a limited extent, locally, in other provinces.

29. Pacupis, *Trichosanthes anguina* L. A cucurbitaceous, climbing vine, cultivated for its long snake-like fruits. It is fairly well distributed throughout both Luzon and the Visayan Islands.

30. Panarien, *Tacca pinnatifida* Forst. A succulent plant, the tubers of which are used in the manufacture of starch. The Panarien is probably indigenous to the Philippines, but seldom cultivated.

31. Parsley, *Carum petroselinum* Benth. and Hook. Of local and limited cultivation.

32. Patani, *Phaseolus lunatus* L. Is very generally cultivated; there are several varieties, nearly all climbing.

33. Patola, *Luffa acutangula* Roxb., and *Luffa aegyptiaca* Miller, two climbing cucurbits, are cultivated everywhere for their edible fruits, which when ripe, furnish the "vegetable sponge."

34. Pea, *Pisum sativum* L. Cultivated locally only; grows best in the mountain districts.

35. Pechay, *Brassica pet-tsai* Bailey, is fairly generally cultivated.

36. Potato, *Solanum tuberosum* L. Cultivated locally only and succeeds well only in the higher altitudes.

37. Pumpkin, *Cucurbita pepo* D C., of which there are four or more kinds, is common in most communities.

38. Radish, *Raphanus sativus* L., of which a Chinese large-rooted, white variety is the one most commonly cultivated, is quite generally grown everywhere.

39. Seguidilla, *Psophocarpus tetragonolobus* D C., a leguminous climber with delicious, tender, edible pods, is of fairly general cultivation. The extended cultivation and use of this excellent legume cannot be too strongly recommended.

40. Síncamas, *Pachyrhizus angulatus* Rich., a leguminous climbing vine extensively cultivated for its fleshy sweetish roots.

41. Sitao, *Vigna catjang* Endl. In general cultivation; several varieties are grown.

42. Squash, *Cucurbita maxima* Duch., of which there are ten or more varieties, is very generally cultivated throughout the Archipelago.

43. Tomato, *Lycopersicum esculentum* Miller. The tomato is among the most commonly cultivated vegetables in the Philippines and succeeds extremely well; those in cultivation are mostly of a poor and degenerate type.

44. Turnip, *Brassica rapa* L. Quite commonly cultivated.

45. Ube, *Dioscorea alata* L., of which there are several varieties. Yams are perhaps next to the camote the most prominent root-crop in the Philippines, of which the Ube is the most important among the eight or more "native" species of *Dioscorea*. As yet hardly ever eaten by any but the native population, the better varieties of this delicious and nourishing vegetable can not be too strongly recommended to the white settler.

46. Upo, *Lagenaria vulgaris* Seringe., of which there are two well defined types, is a cucurbit of very general occurrence in all parts of the Islands.

47. Water melon, *Citrullus vulgaris* L. Very generally grown everywhere, but the melons are of inferior quality.

THE WORLD'S WIDEST-KNOWN FRUIT.

By O. W. BARRETT,

Chief, Division of Experiment Stations.

The orange, the apple, and even the old date have their range limits and spheres of influence, so to speak, on account of the exigencies of transportation and the tastes of the peoples; there is one fruit, however, that with the exception of the natives of Siberia, Thibet, and Greenland, is known in the flesh in practically every country of the world to-day. Twenty-five years ago this statement would not have been true, but a quarter of a century hence, it will probably be even more strikingly evident than it is to-day. Being the most widely known does not mean the *best* known; strictly speaking, the apple is probably the best known scientifically, and the coconut is probably the most important fruit to-day.

The banana, however, though known to comparatively few people in its intimate life history, has traveled farther and helped to feed more human beings than any other fruit. The plant itself being pretty nearly confined to the Tropics is known to perhaps only one-half of the people who know the *fruit*; the latter, at least in some varieties, fortunately endures considerable mishandling and commercial illtreatment, so that the fruits may be sold in Sweden or Canada for a price but little higher than that demanded in countries bordering on the Torrid Zone.

Furthermore, when we come to the point of defining just what a banana is, several difficulties confront us: For instance, is a plantain a banana, and where shall we draw the line in classifying the species in the family as to whether the fruits or the plants themselves should bear native local names or the general term? In the first place, the origins of the words banana and plantain are obscure. The early explorers of Africa claimed that the Guinea Coast natives, as far back as the sixteenth century, called the fruits of the several varieties "banana;" the plant probably came some few centuries previously

from tropical Asia. The first appearance of "plantain" was as the Spanish word "plántano," or "plátano," which signifies the plane-tree—which has nothing to do with the case. No philologist would attempt to prove that plátano, or plantain, was etymologically connected with "pisang," the Malaya word—much less with "saguing," the Tagalog equivalent.

In the Polynesian and African dialects there is usually a deplorable tendency to apply the name of a certain type of bananas to the several varieties thereof, even when considerable differences are in evidence; in other words, while there may be a general word for the plant in a certain island or district there are perhaps four or five popular names for the several types of the fruit, each of which may have several more or less undistinguished varieties. Porto Rico of all countries is said to be the most "particular" and accurate as to the local names of its plants; yet the writer, after three years' study of the banana varietal names there, was still uncertain on some points of the synonymy. This difficulty of distinguishing the varieties, on account of the great similarity of the plants of a given type and of the local variation of the varieties themselves, caused by difference of soil, season, cultivation, etc., has deterred many planters and writers from going to the bottom of the question.

Partly on this account, there is to-day no collection of bananas anywhere that at all approaches completion.

Botanists have always shunned them because it is almost impossible to prepare good herbarium specimens thereof; horticulturists find them difficult propositions because of their uncertain or delayed productiveness and individual, seldom well understood, traits of character; the planter is usually content to raise one or two sorts only—those which will endure the most mistreatment in shipping. Without artificial heat the collector can scarcely hope to dry a specimen of the flower (sic) before it decays, and he stops aghast before the 6-meter leaf of *Ensete*, or the Abyssinian banana. Having no fixed period of flowering, and a root-system sensitive to every influence, these plants satisfy their own whims rather than follow any line of action or fruiting schedule laid down by any horticulturist.

Only one of the 250 or more kinds of bananas and plantains now known has ever been largely "in the trade;" in its home plantations, however, this variety, known as *Jamaica*, *Costa Rica*, *Gros Michel*, *Guinea*, etc., is considered fit for the oxen while other sorts are used on the tables of the planter and his laborers. In short, although the banana is one of the world's oldest cul-

tivated fruits, and the most widely and largely known as a general-purpose fruit, it is one of the least understood, yet one of the most interesting of all economics that concern the welfare of man.

Before the dawn of agriculture as a science, the banana had begun to play a prominent part in human history. From the numerous wild species occurring throughout Africa and southern Asia it is logical to conclude that some and probably all of the domesticated sorts were taken from these continents. Dr. O. F. Cook, an American authority on plant history, suggests that, in company with the closely related *Heliconias* from tropical America, the banana was originally grown as a root-crop; it seems that one or more of the *Heliconias* had been included with a number of other good food-plants when the migration began Asia-ward from the old Caribbean region; but as soon as the root-culture method was applied to the similar-appearing wild bananas—*i. e.*, after a few centuries—it was noted that the fruits, gradually growing less seedy and more edible, were of more account to the native husbandman than the acrid, fibrous bulb at the base of the “stem.”

The fact that one of the old searovers, who happened to be prowling about that part of the coast of South America now called Venezuela soon after Columbus had broken out the route, noted in his log-book that he had sent his “small boats up a river to lay in a stock of these fruits” (probably the semi-cultivated cooking “plantain,” similar to the Sabá of the Philippines), is of great interest.

Most of the really wild bananas are to-day found only in the back districts of Africa and south-eastern Asia; Central America and the larger islands of the Pacific, however, contain many semi-cultivated forms. It is said that perhaps the largest plantains in the world are grown in the great alluvial basin of the Kongo. Many sorts new to horticulture may be discovered among the savage tribes in the hinterlands of the Dark Continent as soon as those regions are “opened up.”

Several varieties have probably been lost in the last two decades in the interiors of the larger islands of the Hawaiian Archipelago; there the natives used to count largely on their many strange and rare kinds of bananas and plantains as a cheap food supply, but since the great sugar estates have drawn the people of the uncultivated interior down to the lowlands, the half-wild cattle, goats, and pigs roaming through their unfenced and abandoned plantations have devoured “root and

branch" the whole stock of some, if not many, of those old and once very important fruits.

In central Africa there are numerous tribes that rely to a very great extent upon the plantain as one of their main rations; in fact, some writers have classified the people of Africa into *date-eaters*, in northern Sudan; *banana-eaters*, in the central regions; *meat-eaters*, in the eastern districts; and *grain-eaters* (kafir-corn, maize, and millets), in the western and southern portions.

Likewise in the Polynesian Archipelagos, the banana vies with the coconut as the most important food-plant; but, as in the case of Hawaii, many of the local varieties are doomed to become extinct within a few decades on account of the change of habits of the people. It is most unfortunate that some government or keenly interested plant lover has not taken up the matter and ransacked the whole Pacific for banana varieties. The exact number of kinds, native and more or less confined to the Archipelagos, can only be vaguely estimated, there probably never having been any attempt to get them all together. Two or three very distinct species are found there only; for instance, the peculiar *Fehi*, bearing the bunch of fruit erect above the stem instead of pendent below the crown of leaves, and having a violet, or blood-like sap; one variety of this type has been successfully introduced into the British West Indies, and a strange, possibly related sort, without the red juice, was found at Los Baños, Laguna, some time ago.

Recently authorities on the botany of this interesting subject have been forced to admit, from the great amount of material which has been brought to their attention, that the differences between bananas and plantains are insufficient to warrant the two plants being considered as really separate species any longer. Formerly all the true bananas were considered as belonging to *Musa sapientum*, while plantains were grouped under *M. paradisiaca* (the latter was fancifully supposed (?) to have been the original "forbidden fruit" in the Garden of Eden legend). There are connecting links and all kinds of gradations separating, or rather joining these two classes of fruits. Some of the so-called plantains, like the *Sabá*, for instance, of the Philippines, are apparently bananas as far as the flowers and fruit-stems go, yet by another classification they belong to the "cooking kind" in which probably all of the so-called plantains should be placed. In fact, after all is said and done, the practical difference between a plantain and a ba-

nana fruit is based upon the fact that the former is eaten only cooked, and the latter both raw and cooked.

However, it must be admitted that among some plantains, notably those of the so-called "Kongo" type, which the writer discovered in Porto Rico in 1902, the fruit-stem is peculiar in having the "bud" of unopened flowers at the tip of the stem entirely dried up instead of being fresh and full of unopened purplish bracts as in the case of the true bananas; many of the plantains of the "Kongo" type, moreover, have but two or three hands, *i. e.*, perhaps ten to twenty fruits in the average bunch; this dried-flower-bud feature is practically never to be noted among the bananas.

By the way, it is interesting to note that in some varieties of bananas the number of "hands" may be double or treble the number seen in commercial bunches; *i. e.*, it is possible to find bunches of bananas with twenty, thirty or even more "hands," each "hand" containing perhaps ten or fifteen fruits; in fact, there are numerous cases on record in which the end of the fruit bunch was below the base of the stem—so that a small pit had to be excavated to prevent the fruits resting upon the ground; this feature occurs probably only with the *Chinese*, or *Dwarf-stem* type and its close relatives, some of which are known as the *Elephant's Trunk* banana.

Banana teratology is full of strange facts. A variety in Porto Rico has the bunch double—one being attached below the tip of the other. In the West Indies a double-stemmed banana is not very rare, while the writer knew of one case in which each part of a double stem *divided again*, thus forming four stems from the one base—each of which might, under favorable circumstances, produce a bunch of fruit. One of the commonest malformations among bananas is the adhesion of the fruits of a "hand;" in pronounced cases of this phenomenon, one unbroken skin covers each layer of the "hand" and sometimes all the fruits of both the upper and lower tiers. Obviously such web-fingered sorts are grown only as curiosities.

While it is manifestly impossible to classify bananas into a definite number of types, the following list will give an idea of the principal groups under which most of the food bananas (including plantains) may be placed:

1. The genuine plantains, represented in the Philippines by the *Tundoc*.
2. The false plantains represented here by the *Sabá*, *Matabia*, etc., and by the semi-wild bananas of tropical America.

3. The red plantains which grade gradually into smaller varieties of "purple bananas."

4. The *Kongos* of the West Indies and probably also of West Africa including both the purple and yellow-skinned forms.

5. The commercial market type, or *Jamaica*, which has comparatively few sub-varieties.

6. The *Chinese*, or *Dwarf*, type.

7. The *Apple*, so called from the fancied odor and taste of some forms.

8. The *Lady-fingers*, including at least three sub-types with rather thin skins and more or less sweetish, yellowish pulp.

9. The *Egg*, or *Hua Moa*, peculiar to the Hawaiian Archipelago, although an apparently related type, the *Ni-lanzon*, of the Philippines, might be included here.

10. The fragrant bananas of the Malayan region (which would be extremely valuable were it not for their fault of dropping from the stem before ripening.)

11. The *Fehis* of the southern Pacific.

12. The more or less seedy, semi-cultivated types of which there are many varieties in Africa, Asia, and the West Indies.

Judging from the writings of Raoul, Watt, and others, it is probable that the present number of distinct banana and plantain varieties is in the neighborhood of 250; probably about one-half of this number would be popularly classed as bananas, while about one-fourth would be plantains, or cooking bananas. It is questionable whether any collection has been made of more than fifty varieties, not including synonymous names, of course. The Chinese banana may be known to more individuals than the old Jamaican, or Costa Rican, which is now more or less familiar to practically every European and nearly every inhabitant of the New World from Alaska to Patagonia. Throughout Africa and tropical America some form of plantain is more often used as food (cooked) than probably any other variety of the family in those regions.

Unfortunately the raw banana is not an ideal food; some kinds, if eaten in quantity, cause indigestion. "Banana baby" is the colloquial name of a comparatively new disease among young children among the poorer classes in large cities. The content of starch and pectin is in such a form that the human stomach can not readily digest it, although, of course, the small amount of sugar is easily absorbed. Cooking, however, quickly changes this more or less indigestible starch or gum into an excellent food. Even unripe plantains and bananas

become digestible when boiled or baked, or even when fried over a slow fire. In fact, it might be roughly estimated that the ordinary ripe banana is rendered five times more valuable as human food *by cooking*. The modern threpsologist has a great amount of work ahead of him in the study of the comparative nutritiousness of the bananas and plantains.

An interesting point to be borne in mind in the study of bananas as food is the ease with which almost any variety can be made into meal or flour; and this plantain meal, or meal made from unripe bananas, is unquestionably one of the richest foods to be found anywhere.

Our neighbors in Saigon are making banana wine and champagne, while a delicious cordial is made in the West Indies; British Guiana is turning out banana coffee; Jamaica exhibits banana sugar; and several countries have done more or less with banana vinegar and dried bananas. By the way, "banana oil," used in metal paints, has no connection with the banana aside from its odor. A few years more and we shall see—let us hope in the Philippines *first*, in time for the increased Panama-canal traffic—all of these products on sale in wholesale lots, and at fancy prices.

In the Tropics of both hemispheres a "concentrated ration" is commonly used as food for invalids, children, and dyspeptics. The method of preparation is comparatively simple: The nearly ripe fruits are sliced or dried either in the sun or in an artificial drier, then ground and stored away from dampness. Upon being mixed with boiling water or preferably baked or boiled as a pudding, "mush" or gruel, a highly flavored and exceedingly wholesome dish is had. In the case of plantain flour the peculiar tart or "sweet-acid" flavor is preserved remarkably well; either alone or mixed with wheat flour or maize meal it makes a fine cake, biscuit, or pastry dainties. For several years various concerns and individuals have been experimenting with the handling of banana flour products and in some cases success has been pronounced; but it must be remembered that the public is almost always very slow to accept a new food, be it fruit, flour, or root. And, therefore, while the general attitude of the American and European housewife is favorable to banana productions, it will require another decade before we shall see the due quantity of such foods in every day use in the North Temperate Zone. The poorer classes will not be able to use banana coffee, banana "chips" (a breakfast food), and the various banana flours, "figs" (dried slices

of ripe fruits), etc., for the reason that these products can never hope to compete in prices, bulk for bulk, with wheat or maize—at least not until banana culture shall enter upon a more favorable era than it now enjoys, especially in such countries as the Philippines.

Humbolt stated that the banana could produce more food per acre per year than any other known economic; while this statement may be justly questioned, there is no doubt that the banana is one of the three best food plants the world has ever known. A hectare planted to bananas is estimated to yield some "133 times as much food as the same area of wheat or some 44 times as much as that area of potatoes."

The consumption of the Costa Rica, or Jamaica variety of bananas is steadily increasing. Costa Rica alone now produces over ₱9,000,000 worth of this variety—which is about one-half of the total export trade of that country. Jamaica produces something like 15,000,000 bunches per year valued at about ₱8,000,000, a large part of these going to the United States while the remainder go to Europe. Brazil ships over 500,000 bunches to Argentina; Paraguay is following Brazil's example, and finds a ready market in the great and rapidly growing emporium of Buenos Aires. Honduras also sends nearly ₱4,000,000 worth of bananas to the United States yearly, while the State of Panama is now sending thither nearly ₱3,000,000 worth.

About 130 "banana boats" are now plying between tropical America and the United States; these steamers are fitted up to take a cargo of about 20,000 bunches. There are several new 5,000-ton steamers on the Jamaica-England run that can carry up to 60,000 bunches; these are fitted with the latest cool-air system which maintains an even temperature of about 13° (56° F.); on account of the danger from either heat or cold during the exposure of handling, the entire 500-car-load cargo must be discharged *in one day*; hence the 300 or more men, as well as the huge lifting cages and the endless-belt conveyors have to hustle.

Unfortunately a very severe disease has appeared within the last few years in the larger plantations of Costa Rica, Honduras, and Jamaica; the plants attacked soon begin to wilt and the entire hill, or stool, gradually dies down; the soil in the immediate vicinity of the attacked plants remains infected for a considerable time. A somewhat similar disease has made its appearance in the Philippines, but thus far has been kept in check. The banana has very few insect enemies, though in the

Philippines a butterfly leaf-roller is in evidence; there is also a root-weevil here, the grub of which bores through the base of the stem, weakening, if not actually killing, the plant.

Reckoning the cost of a bunch of bananas at from ₱0.20 to ₱0.30, on large plantations, and the wholesale market value thereof at ₱0.60, there is clearly a profit of at least ₱0.30 per bunch. With 700 first-class bunches per hectare per annum, the profit should be well over ₱200 per hectare. Local conditions, of course, greatly modify any figure which might be given relative to possible yields and returns in the Philippines.

An expert musologist is, of course, required to get the maximum of good results in a banana plantation. Few people realize that there are at least three distinct types of suckers produced by the mother plant and much depends upon the proper selection and treatment of these reproductive materials. Space does not permit a discussion of this interesting subject here, but in passing, we should note that theoretically, all bananas and plantains can be made to *produce seed*—though, of course, such a method of propagation is of interest only to the horticulturist.

The following directions for causing a banana to produce seeds were given the writer by a Porto Rican native, who was unquestionably a banana-culture expert: Get a stool of bananas growing rapidly in shallow soil by the addition of artificial fertilizers; let one bunch of fruits "set," but before that ripens cut down all but one of the stems in the clump; the remaining shoot, "thinking it has but one more chance to perpetuate its kind before being killed," on account of the tremendous shock to the more or less connected stem bases in the clump, at once produces a small bunch of somewhat abnormal fruits some of which will contain genuine seeds. As a matter of fact, it is a usual thing to find seeds in the commonest of the Philippine bananas, the *Sabá*. This phenomenon has really a great value in the study of musology for it permits us to believe that the vast number of distinct varieties in existence to-day are not necessarily "*sports*" from roots of some ancestral type of by-gone ages.

While no hybridizer may have the courage to attempt to create a new variety from seeds by cross-pollinating two distinct sorts, the expert propagator could undoubtedly, by planting enough seeds, obtain variations and brand-new kinds of seedlings. The existence of perfect seeds in even extremely rare cases, therefore, relieves us from the abominable supposition that the vegetative method of propagation is responsible both for the wonderful *stability* of the present varieties and for the great number

of what we would otherwise have to call "sports" from a few original species.

The number of varieties in the Philippines is probably somewhere between thirty and fifty, although a careful exploration of the interior of Mindanao, Samar, Palawan and the islands of the Sulu group may bring to light a considerable number of additional sorts which are strongly localized; as with the citrus fruits and even the rice varieties, there has been a surprising lack of inter-exchange of varieties between neighboring districts.

There is no special difficulty in banana culture. The plants will, of course, not endure strong winds since the leaves are easily torn and they have no wood in the pseudo-stem, or bundle of leaf-bases; neither can it endure prolonged droughts without showing some effect, although the root-system of the banana is better than that of almost any other crop; in fact, it is so vigorous that some authorities, having noticed the branching effect produced by cutting the roots, have advocated this absurd procedure as a means of increasing the vigor and growth of the plant.

The outlook for a famous future for the banana is excellent. It has been neglected, quite naturally, and is rather conservative, to be sure, but its faults are few and its virtues are almost refulgent when we really get acquainted with it.

MARCOTTAGE: ITS UTILIZATION IN THE TROPICS.

By H. H. BOYLE, *Assistant Horticulturist.*

Excepting cuttage, the only vegetative method employed in the propagation of plants in the Philippines is the method of marcottage, with which, notwithstanding the crude manner in which it is employed by the Filipinos, good results are obtained. Of the asexual methods of propagation, this is, perhaps, the simplest of all, and performed during the rainy season it gives better results with less care than any other; its extended practice may well be recommended where the species used as the stock is of little or no importance. A short résumé of the different methods of marcottage employed in the Philippines, the United States and Europe may, therefore, be of interest.

Marcottage is in Europe known as "circumposition," while in the United States it is commonly known under the term "ringing." The native names for this method of propagation in the Philippines are "balinconcong," "paogát," "paugát," and "pasangá."

In the conservatories of the United States and Europe the following method is employed in the propagation of such plants as *Ficus elastica*, *Codiaeum* (Crotons), *Hibiscus*, *Cordyline* and others when small specimen plants retaining all the leaves around the base are desired within a limited time. The branch or stem to be rooted is girdled a distance of 25 to 40 millimeters in length. The bark in some cases is removed, while in others a number of vertical incisions are made within the horizontal cuts. A small-sized flower pot, which has been broken in half, is then tied in position around the wounded stem with raffia or cord, and the pot filled with a medium of 2 parts soil, 1 part humus, 1 part sand and 1 part live sphagnum moss. The addition of the moss, aside from retaining moisture, insures an even distribution of same to the wound. When suitable roots have been formed to support the new plant, it is severed from its parent, repotted, and kept within a hot frame for a few days, or until it has a thoroughly established root-system.



FIG. 1.—Methods of Binding the Wound for Marcottage in the Philippines. a, Coconut husk; b, Banana leaf.

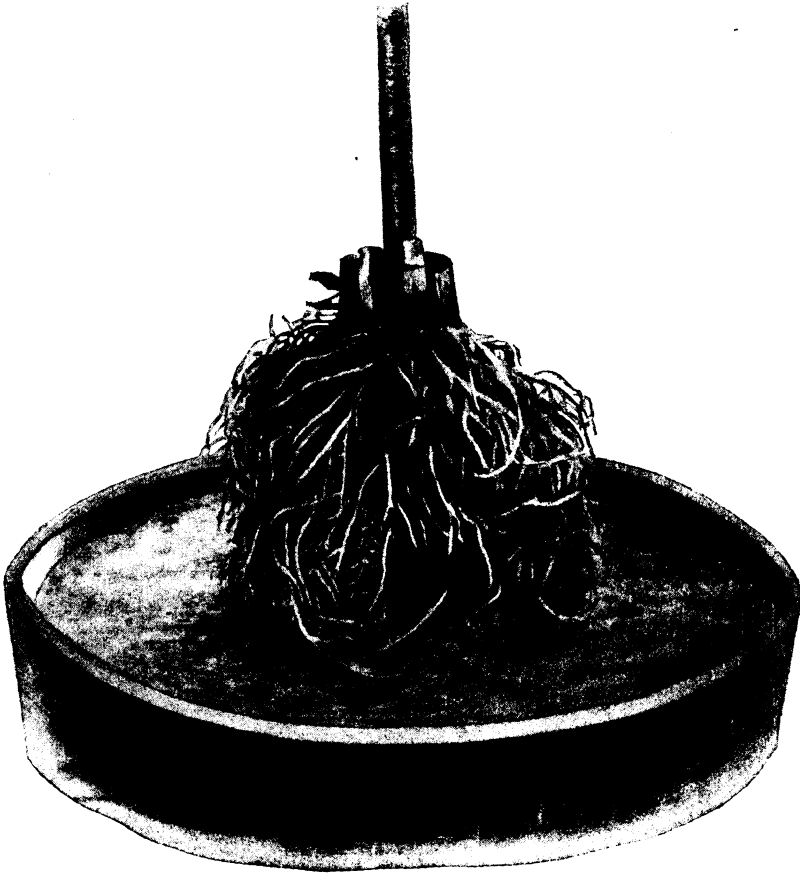


FIG. 2.—Root System Developed in Marcottage by Coconut-husk Method.

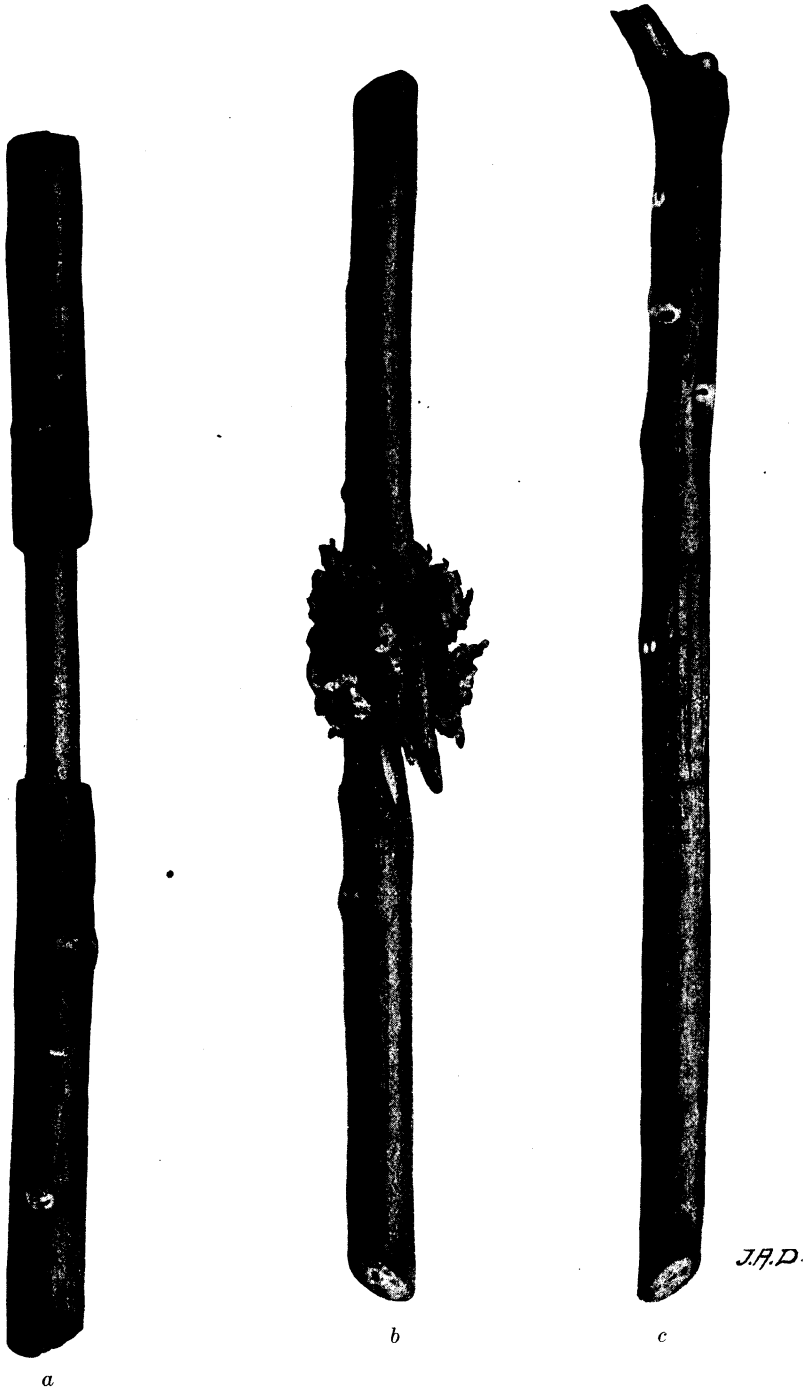


FIG. 3.—*a*, Marcottage Method Employed in the Philippines; *b*, *c*, Marcottage Methods Employed in the United States and Europe.

Another method, which is extensively and successfully used, is as follows: Instead of ringing or girdling the branch which is to be propagated, an oblique incision is made in an upward direction. This incision is usually from 12 to 25 millimeters in length or one-half the diameter of the branch. In this incision is placed a chip of wood of the thickness of a match in order to prevent the healing of the wound, and the wound is now bound up in a small quantity of live sphagnum moss which encourages callousing and the formation of roots. Around the incision is sometimes placed a mixture of live sphagnum moss and clean sharp sand in the proportion of 1 to 6 respectively. This is then bound with raffia or cord. Stiff paper may also be placed in a cone about the moss to hold it in position around the wound. Frequent syringing is necessary to keep the moss in a moist condition so as to encourage root growth. Within three or four weeks from the operation roots will come out through the moss or be seen on the surface of the cone. The scion is then ready to be severed from its parent. The severed portion is now planted in a pot containing light soil and kept in a hot-frame until it is well established.

The following is one mode of propagation in vogue in the Philippines: The branch to be propagated is girdled a space of about 4 centimeters in length at the point where the root-system is expected to form. The bark of the girdled section is then removed and the cambium layer is destroyed by scraping it with the knife. This is done in order to prevent the wound from healing during the period of callousing and of the formation of the roots of the scion. A joint of bamboo, about 15 centimeters long, is now split in half and the pieces placed around the treated branch so that the wound is at the bottom of the tube, after which they are tied together with coconut fiber or other tying material to hold them in position, and the tube filled with soil to induce root formation. When, in the judgment of the propagator, sufficient roots have been formed to support the new plant, the branch is severed from its parent, the bamboo tube is removed, and the severed branch is planted in the garden plat, or placed in a larger tube in a shady place.

Another method, similar to the one described above, is also employed. The difference is that instead of bamboo being used to hold the soil around the girdled section of the branch, a cylinder of banana leaves is placed about the wound. The methods mentioned above are best performed during the rainy season.

In the opinion of the writer a method of binding the wound

with coconut husks employed in some parts of the Philippines in the marcottage of chicos and other plants may well be used extensively, if not universally, throughout the Philippine Islands. The method differs from the one previously described only in that the medium employed to hold the soil and to retain the moisture around the wound is pieces of coconut husks instead of bamboo or banana stalks, and in that a light soil is placed next to the wound to induce root formation. Success has also been obtained by placing only coconut husks about the wound without the medium. Care should be taken that the husk has been thoroughly moistened before it is placed in position; this may be accomplished by soaking the husk in water for a few hours. Within a few weeks of the operation roots will be seen to appear through the sections of the coconut husk and the layered branch is then ready to be severed. The coconut husk is not removed when the plant is set out, but allowed to remain as a part in position. The new plant usually suffers but little when severed from its parent, due principally to the fact that the medium around the roots and the roots themselves have not been disturbed.

The amount of time and care required by plants propagated with the aid of banana leaves, bamboo or sphagnum moss is much greater than that required by this coconut-husk method.

By using the oblique incision instead of girdling the branch or stem and the employment of coconut husks to retain the rooting medium and moisture about the wound, there is obtained such an advantage over the others that the writer recommends this method of propagation in preference to all other methods of marcottage.

The propagation of plants on a large scale by the method of marcottage is practicable in the Tropics only during the rainy season, since when performed during the dry season too much labor is entailed in keeping the coconut-husk coverings sufficiently moist to promote the formation of roots.

RECENT PLANT INTRODUCTIONS INTO THE PHILIPPINES.

By P. J. WESTER, *Horticulturist.*

One of the most important features in the development of a country is the introduction of new plants. Every country has a few species that may to advantage be domesticated, but many regions would be little but uncultivated and worthless deserts, fields or forests except for many plant immigrants, and many necessities and luxuries which add comfort and pleasure to existence would be lacking but for other plant introductions. In this the Philippines are no exception. The Islands are, in fact, the original home of no vegetables and of remarkably few edible fruits, considering their extent and area.

The following species are regarded as indigenous by Dr. E. D. Merrill, botanist of the Bureau of Science: Alubihod, *Spondias mangifera* Wall.; Alupag, *Euphoria cinerea* Radlk.; Bobog, *Sterculia foetida* L.; Cabuyao, *Citrus hystrix* D C.; Calamondin, *Citrus mitis* Blanco; Catmon, *Dillenia philippinensis* Rolfe; Mabolo, *Diospyros discolor* Willd.; Pangi, *Pangium edule* Reinw.; Pili, *Canarium ovatum* Engl.; and *C. pacyphyllum* Perk.

By comparing this list with the annotated lists of Philippine fruits and vegetables on another page, a fair idea may be formed of how much "original material" the Philippines have contributed to the subsistence of the human race, and how much the rest of the world has contributed to the welfare of the Philippines and its people in the way of fruits and vegetables. Most of the food plants in the Philippines have been introduced by the Spaniards, some were prehistoric introductions, and a few have been brought here since the American occupation of the Archipelago. The Spaniards introduced a very large number of economic plants and cereals as well as vegetables and fruits, and it remains for us to complete the work so well begun by them.

When the Insular Bureau of Agriculture was organized in

1902 the introduction and distribution of vegetable seeds of improved varieties became almost at once one of the important features of the work of the Bureau, and this work has gradually grown until some 100,000 packets are now sent out gratis during each season. However, this is only one phase of the plant-introduction work done by the Bureau; the other, the importation of new species, is more particularly the one considered in this paper.

The supply of forage for the Army horses and mules has been a problem ever since the American occupation of the Archipelago, and owing to the great cost at which grain and hay have been transported to the Islands, and because of the obvious desirability of producing these feed stuffs at home, thus effecting a saving of money as well as giving employment to more people, investigations were started by the Bureau with the view of discovering grasses and legumes adapted to the climatic conditions of the Philippines.

In the course of these investigations the native grasses were found to leave much to be desired for forage and attempts were therefore made to import others more suitable.

Among the early introductions the most valuable grass imported was the Guinea grass, which was obtained from Hawaii in 1907. Several varieties of maize, millets, teosinte, and sorghums were also introduced. The velvet bean, introduced about the same year, has proved of greater value than any other legume the Bureau has introduced that has been subjected to extended trials.

While the early forage plant introductions were confined to a comparatively few species, a very large number of both legumes and grasses were brought to the Islands during 1911 by Mr. C. V. Piper, agrostologist in the Bureau of Plant Industry, United States Department of Agriculture, who spent several months in the Islands during that year investigating the forage problem.

The most promising grasses introduced in 1911 include Rhodes grass, Sudan grass, Natal grass and Molasses grass. A large collection of legumes were also introduced, containing many species of *Mucuna* and *Stizolobium*, several varieties of *Phaseolus mungo*, *P. radiatus*, *P. max*, *P. calcaratus*, batao (*Dolichos lablab*), and sitao (*Vigna catjang*). Other species included in this importation were *Phaseolus angularis*, *P. aconitifolius*, *Dolichos biflorus*, *D. atropurpureus*, *Glycine hispida* and *Desmodium tortuosum*. Several of these species will undoubtedly be valuable acquisitions to the forage and cover crops of the Philippines.

More recently Teff (*Eragrostis abyssinica*) has been introduced from Africa and Australia.

Mr. W. S. Lyon, as horticulturist of the Bureau of Agriculture from 1902 to 1907, successfully introduced the following fruits:

Avocado (*Persea gratissima* Gaertn.), the "Chinese Dwarf" banana, caymito (*Cryosophyllum cainito* L.), pitanga (*Eugenia uniflora* L.), *Dillenia indica* L., genipap (*Genipa americana*), loquat (*Eriobotrya japonica* L.), bael (*Aegle marmelos*), a superior guava (*Psidium guajava* L.), *Macadãmia ternifolia*, and myrobolan (*Phyllanthus emblica* L.). Several varieties of grafted mangos from India, oranges, lemons and pomelos from California, Japan and Australia, improved varieties of pineapples, roselle, ceriman (*Monstera deliciosa*) and several other economics were also introduced by Mr. Lyon; however, because of the frequent change of personnel and other vicissitudes, most of them were subsequently lost. The maté (*Ilex paraguariensis*) was also imported during this period. One of Mr. Lyon's most important contributions to Philippine agriculture during his connection with the Bureau of Agriculture and in fact to that all over the world where this legume will thrive was his domestication and introduction of the Lyon bean (*Mucuna lyonii*). Since he severed his connection with the Bureau of Agriculture, Mr. Lyon has among other fruits successfully introduced the casimiroa (*Casimiroa edulis*), cattley guava (*Psidium cattleyanum*), cherimoya (*Anona cherimolia* Miller), biriba (*Rollinia orthopetala* A. DC.), a spineless lime from Trinidad, and salak (*Zalacca edulis*). Mr. E. R. Case, Singalong, Manila, also deserves mention for the several varieties of oranges and pomelos he has imported from Florida and California of which some will undoubtedly prove valuable; his is probably the first successful introduction into the Philippines of the Scuppernong grape (*Vitis rotundifolia*); an excellent variety of cattley guava is another of his importations.

The first large importation of the Smooth Cayenne pineapple was made during the latter half of the year 1911 when Castle Bross.-Wolf & Sons, Manila, obtained five thousand plants from Honolulu, Hawaii; this was followed by a second shipment of equal bulk early in 1912; the Luzon Pineapple Plantation Co., operating in Nueva Ecija, has recently imported two hundred thousand plants from Singapore of this variety.

Aside from these, perhaps the most prominent introductions made by private enterprise, many Americans, both military and civilians, have brought with them or received seeds, plants, and

cuttings of many plants from the United States, which while unrecorded and unknown at present, may suddenly leap into prominence when they come into fruiting.

With a better organization of the division of plant industry in the Bureau of Agriculture and better facilities for the care of the plants—not that these do not yet leave much to be desired—the Bureau has during the past year probably introduced more plants permanently than during its previous entire history. A plant introduction inventory was started by the writer April 10, 1911, and at the date of writing (May 26, 1912) the inventory already includes 1,666 numbers. However, the accessions have this year grown more rapidly than under normal conditions because of the incorporation into the inventory of previous introductions made by the Bureau which have survived and promise to become valuable acquisitions to the horticultural and agricultural flora of the Philippines. Lest some one may be led to believe that the plants included in this inventory are all new to the Philippines it may not be amiss to state that for convenience of keeping the records of the Bureau all seeds imported in bulk and distributed are numbered, as are also the many new plants that are obtained in the Islands by officials of the Bureau for observation and testing at the experiment stations.

The roselle is easily the leading plant immigrant during the past year. Altogether ten separate introductions have been made of this species. Among these that have been tested at the experiment stations of the Bureau, the growth of three varieties has been all that could have been desired and about three thousand packages of seeds, accompanied by directions for its planting and uses, have been distributed since January, the aim being to reach every municipality in the Archipelago. While it is hoped that this wholesale distribution at one bound will add another combined fruit and vegetable to the table of the Philippine resident, it is also believed that the continued experiments in making flavoring extract and wine from the herbage, inaugurated during the present year in coöperation with the Bureau of Science, will yield results that will eventually lead to the establishment of a new industry in the Philippines. The roselle has primarily been introduced for its culinary value, but two varieties have also been obtained from the Gold Coast, Africa, that appear particularly adapted for the production of fiber.

Realizing the important place the growing of citrus fruits may take in the fruit industries of the Philippines, the introduction

of improved varieties from abroad has been one of the special features of the plant-introduction work of the Bureau during the past year.

A large collection of budded varieties of citrus trees was received in February from Mr. A. C. Hartless, Superintendent of the Botanic Garden, Saharanpur, India, including the following varieties of oranges and mandarins: Ladu, Jaffa, Malta Blood, Excelsior, Suntara, Sikkim, Ami-Kinkan, China, Whitaker, Szinkom, Malta, Kaula, St. Michaels, Kishiu, Konda Narun, Satsuma Mikan, Vanilla, Unshiu, Nagpur, and Seville. Mr. Case, already referred to, has presented to the Bureau budwood of the Marsh Seedless and Triumph pomelos, and the following varieties of oranges: Joppa, Ruby, Pineapple, and Valencia Late. The Pernambuco and Ellen pomelos and the Oneco mandarin have been obtained from Mr. E. N. Reasoner, Oneco, Florida. Lastly the Sampson tangelo, a hybrid between the mandarin and the pomelo, of exceptional merit, has been received from the Bureau of Plant Industry, United States Department of Agriculture.

Including the numerous native varieties and types that have been assembled during the past year, in which work several officials of the Bureau have aided, particularly interesting types have been obtained by Messrs. G. G. Weathersbee in Cebu and E. H. Bahr in Bataan and Tarlac; the citrus collection of the Bureau at Lamao now contains by far the largest collection of species and varieties of any group of plants under observation. A number of these may be expected to become commercially valuable for their fruits; others have been obtained primarily in order to test their comparative value as stocks.

One of the most important introductions is the reintroduction of the avocado, of which three types have been obtained, and about two hundred and fifty plants propagated. Two types new to the Philippines have been secured from California during the past year and budwood of superior varieties has been successfully imported from Hawaii and California. Unlike the roselle, which, being an annual, discloses its value in the course of a few months, the value of the avocados grown from the imported seed probably can not be determined in less than five years, and this introduction is therefore not of immediate value.

The cherimoya (*Anona cherimolia* Miller), by some writers considered to be one of the world's three most delicious fruits, is one of the successful plant introductions of the past year. The writer brought seeds of this species, the mamon (*Anona glabra*

L.), and seeds obtained by crossing the cherimoya with the sugarapple, from Florida in March, 1911. Later in the year several lots of mamon and cherimoya seeds were received from correspondents in Hawaii, Florida, California, and Australia, and more recently budwood of the most celebrated cherimoyas in California from Mr. C. P. Taft, of Orange, and F. W. Popenoe, of Altadena. Budwood of many of the varieties in the cherimoya collection assembled by the writer at the subtropical garden of the United States Department of Agriculture, Miami, Florida, during his connection with that institution, has also been received through the office of Foreign Seed and Plant Introduction of the Bureau of Plant Industry, United States Department of Agriculture. The cherimoya varieties introduced during the year may be expected to fruit in three years.

Among the more prominent plant introductions of the year may also be classed the Smooth Cayenne pineapple of which two thousand plants were received from Mr. J. E. Higgins, horticulturist of the Hawaii Agricultural Experiment Station at Honolulu, and a shipment of the Spanish will probably be in the hands of the Bureau before this goes to press. A few slips of the excellent pineapple hybrids produced several years ago in Florida by Dr. H. J. Webber and Mr. W. T. Swingle under the auspices of the United States Department of Agriculture have also been received from the office of Foreign Seed and Plant Introduction, Bureau of Plant Industry, United States Department of Agriculture.

The importation of a considerable number of grafted varieties of mangos from India is another important feature of the plant-introduction work of the Bureau. The principal aim in procuring these is to obtain varieties that produce larger and more acid fruits suitable for canning, and "out-of-season" sorts.

Two varieties of grapes that succeed well in Hawaii—the Lenoir and Isabella—have been obtained from the Hawaii Agricultural Experiment Station. Superior mulberries have been received from California and Florida and *Morus alba*, the species best adapted to silkworm culture, from France.

The following are distinctly new plant immigrants to the Philippines:

Carissa (*Carissa arduina* Lam.), an apocynaceous, spiny evergreen shrub, native to South Africa, with white star-shaped, fragrant flowers. The carissa is equally valuable for its plum-like, reddish fruits, which may be eaten raw or made into a

preserve, and as a hedge plant for which it is eminently well adapted.

Carica quercifolia Benth. & Hook. A dioecious, tall and quick-growing herbaceous plant, assuming the proportions of a small tree, indigenous to South America. The fruits are oblong, tapering toward the apex, about 10 to 15 centimeters long, yellowish, and resemble somewhat the papaya—to which the species is related—in flavor.

Spondias lutea L. A medium-sized tree of rapid growth, with large pinnate leaves, indigenous to the West Indies, bearing small, yellow fruits—about the size of a plum—in large clusters. Being anacardiaceous, this tree is related to the ciruela, cashew and mango.

Cecropia palmata. A small dioecious tree, of rapid growth, with large, palmate leaves, somewhat resembling those of the castor oil plant, dark green above, silvery beneath. The flowers are borne in a catkins, in the axils of the leaves; these develop to long, slender, finger-like, sweet fruits 15 to 25 centimeters long which may be eaten raw; boiled in sirup their flavor resembles that of preserved figs.

Tiess (*Lucuma rivicoa*, var. *angustifolia* Mart.), a small, ever-green tree, related to the chico, is, like the four preceding species, indigenous to the American tropics; it bears yellowish fruits varying in size and form, from that of a small oblong plum to a goose egg; the flesh is golden yellow, richly flavored and in consistency and taste resembles somewhat the yellow of an egg, hard-boiled and sweetened. The fruit contains one to three large, shining seeds.

Boracho (*Lucuma salicifolia*). A tree resembling in habit and appearance the preceding species and having larger but similar edible fruits. It is a native of Mexico and Central America.

Ceriman (*Monstera deliciosa* Liebm.). A climbing, araceous plant with stout stem, and large, leathery, perforated leaves. The fruits are oblong, 15 to 25 centimeters long, resembling a pine cone; the flesh is white and of delicious flavor. The fruit of the ceriman is nearly always seedless.

Tree tomato (*Cyphomandra betacea* Sendt.). A tall shrub of rapid growth indigenous to Brazil, related to the tomato, with egg-shaped reddish brown subacid fruits that may be eaten fresh, stewed or preserved.

Caranda (*Carissa carandas* L.). A tall, thorny shrub or a

small tree, indigenous to India. The plum-like fruit is eaten raw and is said to make excellent preserves.

Many other fruit-bearing species might be mentioned.

The most important fiber plant introduced during the year is the ramie.

Aside from the plant introductions above referred to a very large number of species of ornamental trees, shrubs, and herbaceous plants and palms have been received, most of which have been distributed to correspondents interested in such plants.

The above discussion will give some little idea of the activity of the Bureau relative to plant-introduction work. Valuable as many of these new introductions will undoubtedly prove to be in the course of time to the country and its people, less expense is entailed in procuring many of them than is the cost of many other phases of work by the Bureau, much material being obtained in exchange for seeds or plants peculiar to the Philippines that are desired by our correspondents in other countries.

The plant-introduction work of the Bureau of Agriculture has, however, only just begun. With better facilities that are planned for the care of plants at the experiment stations it is also planned to import a great number of new fruits and other economics that grow in other countries but are still unknown in the Philippines, many in fact scarcely known outside of those countries to which they are indigenous. Among the Anonaceous plants there are for instance about a score producing edible fruits, most of which are unknown outside of their native habitat; the same is true of a very large number of Myrtaeous fruits indigenous to the American tropics, Brazil in particular. There are also new bananas to obtain from Hawaii, tropical Asia and Polynesia, a large number of citrus fruits from Florida, the breadfruits from Polynesia, not to mention such plants as the mangosteen, Durian, Rambutan and other related species that while growing in Mindanao and the Sulu Archipelago still remain to be acclimatized in other islands in the Philippines.

BUREAU STATION REPORTS FOR APRIL.

LA CARLOTA EXPERIMENT STATION, OCCIDENTAL NEGROS.

Although some parts of this province are still dry, we have had our quota of April showers (some 6.3 centimeters). This enabled us to begin planting.

The following seeds have been planted in plats: Twenty-two varieties of soy beans; twenty-one varieties of other legumes, including nine from Cebu, four from Bayombong and one from the Catanduanes; three varieties of Kafir corn; and three varieties of Milo. Eight varieties of grass have been transplanted from boxes to nursery beds.

A few plats of guar, cowpeas, mongos, and soy beans have been harvested. These had all been planted during the dry weather and yielded small crops of seed.

On April 16 we finished the first cultivation of about 25 hectares of our best ratoon cane. This is expected to furnish all the green fodder we shall need for four or five months beginning next October.

Thirteen varieties of experimental cane in plats which were irrigated a few times during the prolonged dry spell are now doing very nicely.

Before the showers came 2 hectares of Guinea grass were revived by irrigation and sufficient forage has been cut daily to feed our stabled animals and give the fifty-seven head of brood mares and colts—which are on native grass pasture—one feed a day. For the sake of economy the grass is put through a feed cutter run by water power.

Notwithstanding the very unfavorable weather for abacá, the ten varieties which Mr. Saleeby brought to this station from Davao last January are looking fairly well. They have been irrigated at intervals of from seven to ten days.

One mestizo colt dropped on the last day of the month was the only addition to our horses during April. He is out of an American Army mare, A-42, by native stallion No. 77.

Native stallion No. 53 is almost entirely recovered from the complaint from which he has been suffering for several months.

Two Indian mestizo calves sired by Nellore bull L-31 have been added to our herd. One young Indian bull was sold during the month. Two half-Spanish goats have produced three kids. These are three-fourths Spanish, having been sired by imported Spanish billy A-103. There has been no increase in either the carabaos or hogs.

Lantana has received the undivided attention of six laborers during the whole of the month. There is probably enough left to keep the same number of men busy for two weeks longer.

Approximately 15 hectares of land have been plowed preparatory to planting. (*H. J. Gallagher, Superintendent.*)

TRINIDAD GARDEN, BENGUET.

The work at Trinidad Garden is divided into three phases: Extension work, which consists of distributing seeds and plants to the people of the surrounding country and stimulating their interest in agriculture; the experimental work, which consists of trying new plants and new varieties of plants already introduced; and the supplying of Baguio people with vegetables and fruit. Of these three, the last mentioned requires the most attention and may be considered as being the most important.

The interest taken by the people of this portion of the country in having gardens of their own is very encouraging and, I believe, is largely due to the influence of this station. The plants with which they have the most success are cabbage, peas, lettuce, radishes, turnips, strawberries and string beans. These do not by any means exhaust the list but are probably the most important. These vegetables seem to be grown more for the Baguio market than for the purpose of adding to the home diet.

A crop which seems to be gaining great favor with the Igorrotes is the American sweet potato obtained originally from the United States Department of Agriculture; it is now well adapted to conditions here by having been carried through three generations on this place. It is satisfactory both as to quantity and quality, facts which have been noted by the Igorrotes, many of whom work here, and as a result it is now being planted quite extensively. The vegetables and fruit grown on this place are delivered in Baguio three times a week, Tuesdays, Thursdays and Saturdays. On these days two wagon loads of produce are taken in and delivered at the homes of the people by whom they were ordered. The list of produce which was delivered last month is as follows: Lima beans, string beans, beets, beet greens, cabbage, carrots, carnations, cucumbers, kohlrabi, let-

tuce, mulberries, peas, radishes, roses, spinach, strawberries, turnips and turnip greens. Area considered, all of these crops bore very satisfactorily with the exception of strawberries. This, however, should not be construed as indicating that strawberries are an unsatisfactory crop for this location. The fact of the matter is that the typhoon of September 27, 1911, one of the most unusual and severe which has ever been experienced here, wrought such havoc in washing out some plants and in covering others that a large portion of the beds had to be replanted after that date, and as a consequence the plants are too young as yet to bear heavily. Now, however, the production is increasing at a very satisfactory rate and it is expected that there will soon be an abundance of berries. (*Austin M. Burton, Superintendent.*)

LAMAO EXPERIMENT STATION, BATAAN.

The work carried on at this station during the past month has been largely that of continuing the experiments already in progress, as follows: Citrus propagation; papaya selection and breeding; roselle tests; top-working old mango trees; yam and legume trials; and pineapple, coffee, abacá, corn and tropical-fruit experiments. During the month just past, operations have been mainly confined to work on the first six of the projects mentioned.

Due to the unfavorable soil conditions prevailing at the Singalong experiment station for the propagation of citrus stocks, it was deemed advisable by Mr. P. J. Wester, horticulturist of the Bureau, to transfer the citrus stock under cultivation there to this station. There are now several thousand young seedling citrus trees growing here, some of which have already been budded with superior varieties of oranges, lemons and pomelos, from budwood received from the United States. It is expected that additional budwood will be received in the near future, and upon its arrival more seedling stock will be budded. After the budded trees have attained a proper growth, it is planned to use them in making a citrus grove, and later to propagate budded trees for general distribution, thereby, it is hoped, improving the citrus-fruit production of the Islands. Recently a large shipment of a number of different varieties of citrus trees was received from India. These trees will be fruited, and in addition budwood will be taken from some and budded on the more vigorous citrus stocks that are growing in the nursery.

Under the supervision of Mr. Wester, work to improve the

quality and fix the type of the papaya fruit has been started. A large number of seedling papaya plants are now growing at the station, from which selection will be made with reference to the shape and quality of the fruits produced on the different plants. From the fruits nearest the standard of perfection seeds will be sown and plants propagated. In addition to selection as a means of perfecting the quality and fixing the type, breeding work will also be employed.

The different varieties of roselle are being tested here to determine the best time of the year for planting and for maximum growth. One hundred square meters of the "Rico" variety now growing on the station is being tested for its yield of herbage to determine the practicability of growing it on a large scale for the purpose of manufacturing sirup, wine and allied products. The two cuttings thus far made, only three weeks apart, have given satisfactory results. Experiments are also being made with several varieties of roselle to determine their fiber-producing qualities.

There are a number of old mango trees at the station which have been severely pruned or "topped." The tree is thus induced to send out young shoots just below the severed portion, and in these shoots will be placed buds of a superior variety of mango. The mango trees thus pruned have already sent out the young shoots and are ready for budding, which will be done in the near future.

The object of the yam experiments is to determine, by means of growing and testing all the different varieties obtainable, the ones that are best adapted for human consumption. A large number of different kinds of yams have been received from all parts of the Islands, from the United States Department of Agriculture, and from various other sources. The experiments are being carried on under the "Barrett Planting and Cultural Method."

In addition to the above briefly discussed projects, the legume trials, pineapple, coffee, abacá, corn and tropical-fruit experiments have of course received attention during the past month with respect to cultivation and irrigation. (*F. C. Kingman, Acting Superintendent.*)

THE BICOL FARM, VIRAC, CATANDUANES.

The Bicol Farm, comprising two and a half hectares of land with stable, was turned over to the Bureau of Agriculture January 1, 1912, by the people of the southern part of Catanduanes

Island for use as a breeding station. It is located 3 kilometers from the town of Virac.

Planting on the farm is very much retarded by the drought which has continued for some time with only scant interruption. It is practically impossible to plow with the means at hand. A large amount of work, however, has been accomplished in grubbing and fence building. With the installation of a pump considerable planting can be done with the aid of irrigation.

Of the forage crops raised so far, cowpeas and Guinea grass have resulted best. With irrigation it will be possible to cut the Guinea grass monthly. The soil, which is a clayey loam, appears to be exceptionally well adapted for this crop. Corn has been grown to some extent for green feed.

The people appear to be well satisfied with the result of last year's breeding and are very proud of their "mulas," a term applied here to the mestizo colts. Some disappointment is expressed now and then on account of the colts not always coming true to the color of the stallion. There are as many mares presented as can be handled with safety to the horses. During the month we had seventy original and thirty-one return services, a total of one hundred and one for the four horses stationed here. A large number of colts are being brought to the farm for treatment suffering from an infection of the navel, due to lack of care at birth.

It has been found of great advantage to change the feed to palay now and then, this having the effect of turning slow and indifferent workers into active animals. In the case of the Arabian horse "Pharaoh," this has been the means of changing an otherwise "dead" horse into a first class worker.

During the month the writer made an inspection of the station at Bagamanoc and found things quite satisfactory considering the fact that only native horses are stationed there and that on account of the condition of the trails only some three hundred and fifty mares are available.

In Pandan what appeared to be a serious outbreak of glanders was found and twelve animals were placed in quarantine. A large number of castrations were effected on this trip.

After one year's work among the people of Catanduanes, especially in the southern part of the Island, the formerly very prevalent disease of lymphangitis has practically disappeared in the vicinity of Virac and it is hoped that within another year the whole of the main island will be free from it. (E. H. Koert, *In Charge.*)

TRINIDAD STOCK FARM, BENGUET.

The most noteworthy feature of the work performed at this farm during the past month has been the routine duties of looking after the stock which the Bureau has assigned to this station for breeding purposes. The chief portion of the time, however, has been, and is, devoted to the care of cows that have calved. We have also been quite busy destroying the cattle ticks which have become so numerous of late. I can say that our efforts have met with partial success, and I have every reason to believe that we will be able in the near future to eradicate this pest. The formula which has been employed at this place for the purpose of destroying cattle ticks is as follows:

Arsenic trioxid, commercial	pounds....	8
Sodium carbonate, crystallized	do.....	24
Yellow soap	do.....	24
Pine tar	gallon....	1

Dissolve the arsenic in 20 to 30 gallons of water by boiling thirty to forty minutes. Add water to make 100 gallons. Dissolve the soda in 20 to 30 gallons of water; dissolve the soap (shaved) in the soda solution; pour the tar into this in a fine stream, stirring at the same time; mix the two solutions; add enough water to make 500 gallons. (This formula was introduced here by Dr. Gearhart.)

The cattle are sprayed every ten days with this mixture.

During the past month we have been getting the fences in good condition before the rainy season begins, as it will be impracticable to do this after the rains commence.

This year's breeding was started on April 15, and the thirty-two Mestizo cows and heifers have been placed with an Indian (Nellore) bull. The twenty-one Chinese cows are with an Angus bull. The Galloway bull has with him four selected mestizo cows.

The undersigned is of the opinion that the calves next year will be born at closer intervals than has been the case this year; this will be due to the fact that all cows were placed with bulls on the same date.

The extreme drought which has existed for the past few months has been broken by two good rains during the past week; these rains were 3 and 5.7 centimeters respectively. Although these rains were quite generous in this locality there was only a slight precipitation in Baguio.

The grass will no doubt improve wonderfully in the next few days, and this will likewise better the condition of the herds, which subsist entirely upon grass at this farm. (*A. L. Bradley, Acting Superintendent.*)

CURRENT NOTES¹—JULY.

POSSIBLE FUTURE PLANT INTRODUCTIONS.

The Pomona College Journal of Economic Botany for February, 1911, contains a most interesting and well illustrated paper on the Botanic Garden of Pará, Brazil. The wealth of plantlife in the large valley of the Amazon River is well represented in the Pará Botanic Garden. Many strikingly ornamental plants found there have not yet been introduced into other parts of the world. Of the greatest interest are perhaps the following tropical fruits, all of which are practically unknown outside of Brazil and one only of them, the biriba, has been introduced into the Philippines:

- Mangabeira, *Hancornia speciosa* Gom.
- Amapa, *Hancornia amapa* Huber.
- Uchi, *Saccoglottis uchi* Huber.
- Umari, *Poraqueiba sericea* Tul.
- Castanheiro, *Bertholletia excelsa* HBK.
- Piquia, *Caryocar villosum* Pers.
- Inga cipo, *Inga edulis* Mart.
- Pajura, *Parinarium montanum* Aubl.
- Parinari, *Couepia chrysocalyx* Bth.
- Sorveira, *Couma guyanensis* Aubl.
- Oity, *Moquilea tomentosa* Bth.
- Abiu, *Lucuma caimito* RS.
- Cutiriba, *Lucuma rivicoa* Gaertn.
- Baury, *Platonia insignis* Mart.
- Bacury-pary, *Rheedia macrophylla* Planch & Triana.
- Biriba, *Rollinia orthopetala*, A. DC.
- Jaboticaba, *Myricaria cauliflora* Berg.
- Grumixama, *Stenocalyx brasiliensis* Berg.
- Araça do Pará, *Britoa acida* Berg.
- Cupuacu, *Theobroma grandiflorum* Schum.
- Pupunha, *Guilielma speciosa* Mart.

¹ Original notes prepared by various members of the Bureau of Agriculture.

The Bureau of Agriculture has recently entered into correspondence with several scientific institutions in Brazil and in due time we hope to see several of the above fruits in the Philippines. (*P. J. Wester.*)

BANANA COLLECTION.

After having made a preliminary survey and census of the Philippine bananas and plantains, the Bureau of Agriculture is now contemplating the establishment of as complete a collection of these fruits as possible. Correspondence is solicited with all who are interested in getting together a collection of these valuable fruits, which shall be excelled by none in the world.

No material should be sent to the Bureau, however, without previously advising the Director of Agriculture, and receiving his reply.

In exchange for rare varieties of these fruits the Bureau purposes to furnish seeds and seedlings of other economic plants; in some cases, of course, it may be necessary to purchase the banana suckers. With the earnest coöperation of Philippine planters and with ordinary success in the line of exchanges with other countries, it is hoped that we shall have 100 varieties growing in this collection within two years. (*O. W. Barrett.*)

BANANA DISEASE.

The tropical banana disease which has caused such heavy losses to planters in Costa Rica is gradually spreading to the famous Bocas del Toro district of Panama and to Dutch Guiana, Trinidad, and Jamaica. Especially in the Island of Jamaica, whose prosperity depends so largely upon the banana crop, every effort is being made to check the spread of the disease. The affected plants are cut down, the roots dug up, and the entire material, together with the soil about the roots, is treated with lime and exposed for some time before any attempt at replanting is made. Even the feet of all persons and animals passing through the plantations are disinfected in order that the specific bacteria which cause the disease may not be carried to the adjoining estates. (*O. W. Barrett.*)

A NEW OIL.

Italy has recently given the world another new vegetable oil. The Province of Parma annually conserves some 84,000 tons of tomatoes. The seeds, although really constituting but a small percentage of the residue from the canning factories, yield a

considerable quantity of oil somewhat resembling that of cotton seed. At least 600 tons of tomato-seed oil have appeared on the market, and it is probable that other countries will follow the economic example of Italy. (*O. W. Barrett.*)

FORMOSA, OUR NEW RIVAL.

The canning industry of Formosa has recently taken a distinct turn for the better. The principal pineapple-canning factory there is now capable of handling 10,000 cases of 2 dozen cans each per annum. On account of the new customs tariff, which was put into effect in July, 1911, the pineapple industry virtually enjoys a monopoly at present.

A Japanese confectioner in Tainan, South Formosa, claims to have discovered a process by which the banana may be canned, and has interested several wealthy Japanese with the result that a ₱200,000 company has been organized to build two factories, one in Tainan and the other in Taihoku. Since it has heretofore seemed to be practically impossible to conserve any kind of bananas in tins or jars, the result of this new process will be watched with great interest by the Philippine planters; should it succeed this Archipelago will have another very promising industry—providing patent rights can be obtained. Experiments should be made along this line in the Philippines.

Orange planting in northern and southern Formosa is now on a sure footing; some of the plantations are subsidized by the Government. (*O. W. Barrett.*)

THE STUPENDOUSNESS OF COPRA.

It is stated, on good authority, that the present European output of coconut-oil margarine is approximately 1,000 tons per day. We cannot realize what this enormous quantity means, but but when we consider that it is enough to supply 20,000 hotels using 5 kilos each per day and 3 million families using 2 pounds of vegetable butter each per week, we get some conception of the tremendous importance of this new staple food product.

However vast as this quantity is which goes into tinned butters, I estimate that it accounts for only about one-half of the total amount (some 700,000 tons per annum) of the copra received at the coconut-oil factories of the world. The copra-export figures are now *more than double those for dairy-butter exports.* (*O. W. Barrett.*)

ANOTHER COPRA DRYER.

In *Tropical Life* for February, 1912, the editor, Mr. H. Hamel Smith, puts before the public a modified form of the old "dry-house" kiln. The plan is simply to force hot air by means of ventilator fans into the building at the bottom and out at the top; inside the building there may be four to six perforated or lattice-work floors, one above the other, upon which the raw material is spread. The large amount of floor space compensates for the somewhat longer time required in completely drying out the material.

The difficulties of this system are: To obtain an adequate supply of hot, dry air without at the same time admitting smoke from the fuel (husks and shells, of course) furnace; economical handling of the material inside the building; and the initial expense of constructing a large drying room (with perhaps "half an acre" of floor surface) which should be practically insulated from the cooling effect of rains, winds, etc., together with the machinery for running the ventilating fans. The advantages are the enormous quantity of material turned out at each discharge, evenness of quality, freedom from scorching troubles, and the remarkable cheapness of operation.

In the same number of *Tropical Life* appears an article on "The Philippine Coconut Status" by the author of this Bureau's coconut bulletin. In view of the recent phenomenal increase in Philippine copra exports, however, the figures given in the said article are altogether too low for our present output. (*O. W. Barrett.*)

NEW COPRA COUNTRIES.

Trinidad, in the British West Indies, has recently begun to export copra. We recently gave notice of the installation of a copra dryer in British Guiana, but it appears now that Trinidad is rapidly gaining over that colony, its export for 1911 being some 1,000 tons. In 1907 the writer inspected a small, but very economical and profitable coconut-oil and copra plant in the southern peninsula—in sight of the gigantic palms in the delta of the Orinoco River of Venezuela. The principal export in this line from Trinidad is, of course, the raw nut, of which some 19 millions are exported yearly.

With the growing demand for coconut-oil products and the advantage of reducing the bulk of shipments, it is almost certain that there will soon be plenty of copra plantations not only in

Trinidad, but in Jamaica, the Guianas, and probably in Santo Domingo—providing the bud-rot, which is now rapidly destroying the coconut industry in Cuba, does *not* spread to these countries. (O. W. Barrett.)

ANOTHER NEW FOOD-PRESERVING METHOD.

From the United States Consular Reports, we learn that there is before the public a new Argentine process of preserving meats, fish, and vegetables. The invention, which is patented, is said to consist in the preparation of a *fluid* which may be used by the housewife as well as in large establishments. It is said to contain no antiseptics or any other substances injurious to health. (O. W. Barrett.)

SAGO.

The Administrator of the Territory of Papua (New Guinea), Mr. Staniforth Smith, has recently made a remarkable trip of exploration through the previously unknown Western District of that Colony, and finds that the sago palm, which in the Philippines appears to be confined to the lowlands, grows there up to an elevation of more than 1,000 meters. With the supplementary crops of breadfruit, bananas, yams, and sweet potatoes, the wild tribes of the interior of Papua live on sago as the *pièce de resistance*.

Mr. Smith's discovery will undoubtedly create considerable surprise among horticulturists and will result in the sago palm being placed in a still higher class of economic plants. Though probably confined to districts having a fairly heavy and well distributed rainfall, there is not much doubt but that sago could be grown throughout the interior of Mindanao, and probably in most other mountainous districts of the Philippines, especially along watercourses. Since this palm, unlike most others, *suckers from the stump*, a plantation once established needs very little attention, as is proved by the famous sago forests on the Agusan River in Mindanao. These forests, if economically exploited, would supply annually many thousand tons of a food practically as nutritious as rice.

In passing, it is of interest to note that in the said Western District of the Colony, maize is unknown and coconuts are exceedingly rare except on the lower reaches of the larger rivers; mangos are unknown and, strange to say, cassava has not yet—after probably a thousand years—found its way back into the interior. On the other hand, the natives cultivate several very interesting vegetables and fruits of their own, which will now

within a few years be introduced to the general public. (*O. W. Barrett.*)

RUBBER AND BUTTONS.

Why does the price of rubber affect the price of buttons?

Without understanding something of the labor conditions of South America, it is difficult to connect these two ideas, but, as a matter of fact, there is a reciprocity in the prices.

The virgin forests of Ecuador, Southern Colombia, and Western Brazil contain almost unlimited amounts of taqua, the palm-like, short-stemmed tree which produces the vegetable-ivory nuts of commerce. The nuts are gathered by the Indians living in the jungles, and "packed" to the coast towns; donkeys or mules are used on the more open trails, but the back of the Indian, too, must bear the heavy loads down to the roadways. Providing the Indians have what they consider proper wages as "seringeiros," or rubber gatherers—that is, if the rubber agents in the Andean jungles can afford to offer a *good* rate, the natives become rubber tappers; otherwise, they put a larger supply of taqua upon the market.

Some six years ago the writer investigated this subject and found that the commercial value of these nuts was some 15 million pesos per annum, although most commercial firms estimated the value at only a small fraction of that amount. Most of the raw material goes to Germany, where, especially in the town of Schmolln, the nuts are sawn, cut, and polished—by female operatives.

In Colombia a rich sweetish paste made of the contents of the unripe nuts is a common food in the markets of the interior during a considerable portion of the year; it is known as "Pipa de Jagua," and resembles the "jelly" of half-ripe coconuts. Millions of buttons are thus lost to trade through the Indians' appetite for this rare natural "dulce": such are the freaks of commerce!

Recently the taqua, or corozo, has a rival in trade—the "palma dum" kernels from Africa. A few trees of these vegetable-ivory palms are found in the Philippines; at the San Ramon Farm near Zamboanga may be seen some fine specimens. Unless some of the new button materials, such as "ivorite," "galalith," and "steinan" can be turned out more cheaply, it is possible that within a few years we may see plantations of the button palm here in the Philippines. It appears that a small quantity of button kernels are now being shipped from some of the Pacific archipelagos. (*O. W. Barrett.*)

FERTILIZERS.

Most Philippine soils are improved by organic fertilizers. Many sections of the Archipelago could readily establish fertilizer plants utilizing fish-refuse, sharks, and even certain varieties of fishes which are not of much value as food.

Russia, realizing the possibility of this industry, has erected at Baku a large factory for the handling of fish-waste with the idea that this will enable Russia to supply practically all of the domestic demands for this kind of fertilizers. (*O. W. Barrett.*)

A MAIZE BULLETIN.

Perhaps never in the history of the Philippines has there been such a severe drought as the one through which the Islands have just passed. Such drought means failure, if not utter absence, of all irrigated crops, especially rice. Fortunately, however, there are a few crops which can be grown under drought conditions, or at least with a very slight rainfall; many varieties of both Kafir corn and maize will endure considerable drought; and again there are a great number of varieties of these crops which are very early, that is, only 50 to 70 days from the time of planting are required to get crops.

During the last few years the tremendous importance of maize has become evident in the Visayas, and it is bound to come, soon, we hope, that the maize habit will grow upon all other districts of the Archipelago.

The Bureau of Agriculture has for the past six years been striving to interest the planters, especially in Luzon, in the advantages of growing one or two crops of maize per year on practically all kinds of cultivated lands. If this system were followed, the troubles and real dangers of shortage in the rice crop would be very greatly lessened.

In furtherance of this policy the Bureau is now publishing a maize bulletin which will, it is believed, serve as a guide to the planters of the Philippines in this line of agriculture. The bulletin covers all phases of the industry from selection of seed and testing of same to the storage and handling of both the grain and forage. This bulletin has been prepared by Mr. S. H. Sherard who has had several years' experience in maize growing in various provinces of the Archipelago. (*O. W. Barrett.*)

AGRICULTURE NOT WITHOUT HONOR.

Dr. Inazo Nitobe, Ph. D., the distinguished scholar whom the Government of Japan sent to America recently to lecture to the leading Universities there on the new questions in and the development of his country, made the following statement concerning the status of the farmer in Japan: "With us agriculture was, even in early times, held in the highest esteem. The four social classes into which according to their occupation people were divided comprised the samurai (warriors in the front ranks), then the tillers of the soil, followed by artisans and traders. It was not unusual for the tiller of the soil to pass into the ranks of the samurai, or for the samurai to engage in farming without detriment to his dignity." (*S. H. Sherard.*)

INCREASING INTEREST IN ANIMAL INDUSTRY IN THE TROPICS.

During the past three years Japan has purchased over 300 bulls, mostly of the Kankreji type, from India. Brazil and other South American countries are importing large numbers of several races of zebus. A Cuban cattle breeder is considering the importation of Gujerat cattle into that Republic.

Some two hundred or more years ago a few Senegambian bulls were introduced into Porto Rico by the Spaniards. This race of cattle, which happens to resemble somewhat the famous Africander cattle of central South Africa (and which may be a distinct subspecies), has succeeded splendidly in that Island; and Jamaica, recently becoming interested in the cattle business, is now importing these Porto Rican bulls, which are still of more or less pure West African blood, for crossing with the native Jamaican cattle.

Although Cuba has spent millions of pesos for sugar-estate mules in the last three decades, very little effort has been made toward the breeding of these animals in that Island. The central agricultural station at Santiago de las Vegas is now maintaining a special breeding stud, however, and it is expected that the industry will increase rapidly, since it has been demonstrated that first-class mules *can* be raised there. Porto Rico has also begun mule breeding in earnest.

It is understood that there is a considerable demand for hinnies in lieu of mules in Mexico and the south western section of the United States; it is claimed that the hinny is just as hardy and sure-footed as the mule, while being somewhat easier to raise. (*O. W. Barrett.*)

PRINCIPAL PHILIPPINE IMPORTS AND EXPORTS— APRIL.

By the INSULAR COLLECTOR OF CUSTOMS.

[Values in dollars United States currency.]

IMPORTS.

Articles.	Manila.	Cebu.	Iloilo.	Total.
Rice	Kilos 11,398,735	6,887,489	3,427,599	21,713,823
	Value 472,460	276,034	143,561	892,055
Beef cattle	Number 663		100	763
	Value 14,453		2,557	17,010
Sugar	Kilos 149,404	28,123	27,833	205,360
	Value 11,853	2,197	2,200	16,250
Coffee	Kilos 12,582		163	12,745
	Value 4,974		93	5,067
Cacao	Kilos 86,125	17,064	1,551	104,740
	Value 28,053	5,748	421	34,222
Eggs	Dozen 400,888	238	188	401,314
	Value 32,337	21	26	32,384
Raw cotton	Kilos			
	Value			

EXPORTS.

Hemp	Kilos 13,861,238	2,301,666		16,162,904
	Value 1,543,628	264,009		1,807,637
Sugar	Kilos 22,068,237	1,063,182	11,408,147	34,534,566
	Value 1,279,600	66,678	659,531	2,005,809
Copra	Kilos 9,483,005	5,661,936	505,240	15,650,181
	Value 1,164,928	541,600	47,900	1,754,428
Cigars	Number 13,481,506			13,481,506
	Value 224,675			224,675
Cigarettes	Number 4,905,500			4,905,500
	Value 3,588			3,588
Tobacco	Kilos 601,803		7	601,810
	Value 104,791		22	104,813

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

By the DIRECTOR OF THE WEATHER BUREAU.

APRIL, 1912.

[Temperature and total rainfall for 24 hours beginning at 6 a. m. each day.]

Date.	Hemp.				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.		Temper- ature.	Rain- fall.	Temper- ature.	Rain- fall.	Aparri.		San Fernando.	
	Temper- ature.	Rain- fall.	Temper- ature.	Rain- fall.					Temper- ature.	Rain- fall.	Temper- ature.	Rain- fall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	27.1		26.9		27.5		28.4		24.9		26.2	
2	27.9		27.4		27.9		27.8		25.2		28	
3	28.1		26.7	1.3	27.9		28.4		26.4		27.8	
4	28.4		25.4	13.7	28		29		25.8		29	
5	28.4		26.8		28.8		29.7		26		28.5	
6	27.8		27.4	11.9	28		28.6		25.8		28	
7	28.4		26.6	28.4	28.1		30.7	2.3	26.4		30.6	
8	27.3		27.5	5	27.8		28.4		25.8		30.2	
9	29		27.4		28.6		29.3		26		29.4	
10	29		26.4	26.7	28.6		30.6		26.7		29	
11	27.2	10.9	26.6	4.1	28.2	4.6	31.2		25.8	2.5	29.6	
12	27.6	7.6	26.5	2.8	28.1		30		22.8	23.6	28.6	
13	27.5	12.7	26.8	2	28		28.7		25.6		28.6	
14	26.9	7.6	27.1		28.2		28.6		26.4		28.8	
15	27.4	9.9	27		28.4		28.2		26.7		28.3	
16	28.4		26.6		28.4		28.6		26.5		28.8	
17	28.2		26.9		28.6		29.5		26.1		28.6	
18	28.1		27		28.7		28.4	2.5	26.6		30.2	
19	28.8	12.2	28		29		28.4		27.3		30.3	
20	28.2	1.5	28.2		29.4		27.5		27.5		29.6	
21	28.5	2.3	28.7	.5	29		29.3		27.4		29.4	6.6
22	27.9	1.1	28.5		29.6		29.2		27.2		30	
23	29		28		28.9		29.6		27.7		29.8	
24	28.6		27.9		28.4		29.4		27.5		30	
25	28.9		27.8		29.2		29.6		27.3		30.5	
26	28.8		27.3	20.1	28.6		29.4		27.8		29.2	
27	28.3	9.9	26.6	5.6	28.1		30.6		26.6		30.7	
28	26.8	27.9	26.7	3.8	29		29.2		27.5		29	
29	28.4		27.8		29.6		30.5		27.6		29.6	
30	28.5		27.6		29.4		31.4	44.2	28.4	1.5	30.2	

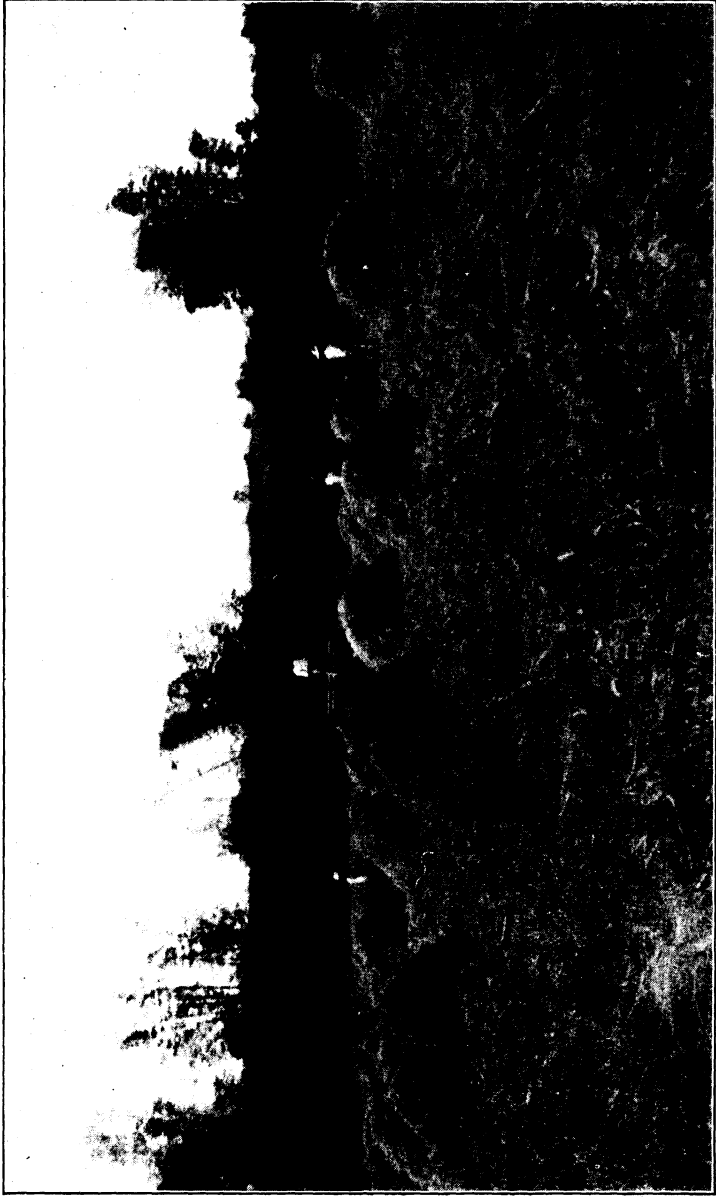


PLATE I.—COCKS OF RHODES GRASS FOR THE NIGHT DURING CURING.

THE PHILIPPINE *Agricultural Review*

VOL. V

AUGUST, 1912

No. 8

CONTENTS AND ILLUSTRATIONS.

CONTENTS.

	Page.
Editorial	415
Bureau of Agriculture Circular No. 15, The Mango	418
Notes on Forage Plants in Java and India, by C. V. Piper, Agrostologist, U. S. D. A.	428
Philippine Kapok, by M. M. Saleeby, Fiber Expert	432
Notes on the Propagation of Rhodes Grass for Hay, by Dr. H. F. Hungerford	438
Agricultural Extension Work, compiled by S. H. Sherard, Agricultural Inspector	444
Agriculture in the Catanduanes Islands, by E. H. Koert, Agricultural Inspector	454
Bureau Station Reports for May	458
Current Notes—August:	
A New Branch of the Citrus Industry; Hybrid Anonas; Agriculture in Africa; Intensive Farming; Still Another New Industry; Lima Beans in Cebu; New Teas; Whales and Coconuts; Egg Powder; A New Kind of Exposition; Carabao in Europe; The Cherimoya in California; Bureau of Education Corn-growing Contests; A New Textile Industry; Filariasis (Thread Worms) of Fowls; Erratum	461
Monthly Veterinary Reports, February to June	472
Statistics on Principal Philippine Crops for Fiscal Year 1911	474
Principal Philippine Imports and Exports—May	475
Temperature and Rainfall for Agricultural Districts in the Philippines—May	476

ILLUSTRATIONS.

PLATE I. Cocks of Rhodes Grass for the Night During Curing	Frontispiece.
	Facing page—
II. Hauling Rhodes-grass Hay from Field to Barn	430

TEXT FIGURES.

	Page.
FIG. 1. The Pound Method of Shield-budding the Mango	421
2. Method of Laying Out Main Ditch and Laterals in Irrigating Rhodes Grass	440

EDITORIAL.

AGRICULTURAL DEMONSTRATIONS.

In 1904 the United States Department of Agriculture started its agricultural demonstrations for the instruction of a few farmers in western Texas. Seven years later a force of six hundred agents was employed on this work, and instructions were being given to one hundred thousand farmers in thirteen different states. It would be quite impossible to measure the results obtained, but the rapid growth of coöperative demon-

stration work and its enormous development within a period of a few years furnishes some indication of its value.

The object of agricultural demonstration work is to furnish a means of reaching and influencing the men on the farms. The essential features of this work are that the agents come in personal contact with the farmers; the farmers participate themselves in the demonstrations; and, under normal conditions, there is practical certainty of success.

In the future development of agriculture in the Philippine Islands, demonstration work promises to play an important part. This work is already well established in several different provinces and is receiving the hearty support of the people. About fifty demonstration plots are now being cultivated in the Provinces of Cebu and Iloilo, and there is an urgent demand that the work be extended.

Demonstration work is deservedly popular for the reasons that it is practical, and that it produces definite and positive results. The farmer who, with his own hands, grows a larger and a better crop under the supervision of a demonstration agent does not have to be convinced by argument that this work is practical. The results are before his eyes, and the profits are in his own pocket as soon as the work is finished.

THE SPANISH EDITION OF THE PHILIPPINE AGRICULTURAL REVIEW.

From various communications received by the Bureau of Agriculture in regard to paid subscriptions to the Spanish edition of THE PHILIPPINE AGRICULTURAL REVIEW, it appears that there is more or less hesitancy in subscribing on the part of some people desirous of obtaining copies in Spanish, through the fear that this edition will be done away with in the near future.

To eliminate this uncertainty, it may be stated that, from present indications, it is very improbable that the Spanish edition will be discontinued for some time to come.

If, in the course of time, this step should become necessary, one of two things would be done: Either the Spanish edition would be continued until all outstanding subscriptions should have terminated, or, if this were impracticable on account of a small number of subscribers, these few subscriptions would be refunded. Thus there could be no possibility of loss on the part of a subscriber to the Spanish edition.

There are to-day throughout the Philippine Islands a large number of people who can make an intelligent and advantageous use of the English edition of the REVIEW, and this number is

constantly increasing from year to year in direct proportion to the increasing enrollment of pupils in the public schools of the Philippines. These English-speaking people, however, are in the main confined to the younger or coming generation of Filipinos.

On the other hand, there is a large number of people in this Archipelago who are to-day, and will be for many years to come, an important factor in the political and industrial development of the Philippine Islands, and yet who are not conversant with the English language. Reference need only be made to the fact that the majority of provincial Filipino office-holders and the greater part of the large landowners belong to this class. These are men for whom the school-day period has passed, and who do not have the inclination or the time to take advantage of the present opportunities for learning English.

The editors of the REVIEW feel that it would be a mistake to ignore this important element in the present-day life of these Islands, and it is with this idea in view that it has been decided to continue the publication of the Spanish edition. It is to be hoped that this policy will be appreciated, and that the Bureau of Agriculture, through the REVIEW, will thus be able to materially assist the farmers of to-day, as well as those of the future.

BUREAU OF AGRICULTURE CIRCULAR
NO. 15—THE MANGO.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
DEPARTMENT OF PUBLIC INSTRUCTION,
BUREAU OF AGRICULTURE.

THE MANGO.

By P. J. WESTER, *Horticulturist.*

(Circular No. 15. Manila, February 7, 1912.)

INTRODUCTION.

The mango is undoubtedly the most esteemed of all the Philippine fruits and yet its cultivation, notwithstanding the luxuriance with which the tree grows, can be said to be scarcely in its infancy. It has been estimated that under ordinary conditions only 23 per cent of the mango trees yield a satisfactory return; this is due partly to neglect, but principally because the trees are all seedlings, and when certain insects, destructive to the bloom and fruit, appear, this yield is still further reduced. However, by taking the proper measures as outlined in this circular, by topworking the old trees, by planting only budded orchards, and by combating the insect pests, it is believed that the yield of fruit can be greatly increased.

PROPAGATION.

General remarks.—Planting the seed “at stake,” that is, where the tree is to remain in the orchard, and planting the seed in a bamboo tube, later to have the plant set out in the field when it has attained a height of 20 to 30 centimeters, with a view to budding or grafting the plant as soon as it is well established and sufficiently large for the purpose, are probably the most preferable methods of starting an orchard for the average planter of mangos in the Philippines.

Unless properly cared for the mango seed rapidly loses its vitality and should therefore either be planted within a few days after the fruit is eaten, or if this is not convenient, the seed

should be placed in a box and covered with moist earth, sand, or sawdust, until it can be planted.

The nursery.—If it is planned to grow the plants in a nursery, this and a seedbed should be prepared by grubbing the soil thoroughly to a depth of 30 centimeters, carefully removing all stones and trash, and if the soil is poor it is well to incorporate with it some well decayed stable manure, compost, or lacking this, a complete commercial fertilizer.

Plant the seeds about 10 centimeters apart in the seedbed, laying them flat on the ground and covering them 1 to 2 centimeters with soil. If planted deeper the seed frequently decays instead of germinating, particularly in heavy soils. When the plants are about 15 centimeters high transplant them to the nursery, about 20 to 30 centimeters apart in rows 1 meter or more apart, to suit the planter's convenience. Trim off about two-thirds of the foliage of the plants before the transfer and prune back the tap root to a length of 10 or 15 centimeters. Unless the transplantation has been preceded by a good rain, water the seedbed thoroughly and, if possible, perform the transplanting on a cloudy day or late in the afternoon. Unless the work is performed during the rainy season when the land is abundantly moist and the rains frequent, the plants should be well watered after they have been set out.

The seed may also be planted directly in the nursery rows, but whether they are planted here in the seedbed or "at stake," it is well to mulch the ground well with straw or leaves after having planted the seed. It is likewise well to mulch the nursery after the plants have been set out there. If the seed is planted direct in the nursery the plants should be gone over when about 15 to 20 centimeters high, and a sharp spade thrust into the ground diagonally under each plant severing the tap root 10 to 13 centimeters from the soil surface. This will induce the formation of a better root system and facilitate the transplanting of the plant from the nursery to the orchard.

Budding and grafting.—The reasons why the mango grower should bud or graft his trees are several: (a) The trees are rendered vastly more productive; (b) fruit of any given variety may be produced; (c) the season of ripening is to a large measure under control; (d) the trees are apt to fruit earlier; (e) the trees become more or less dwarfed and thus the fruit is gathered more easily and insect enemies are controlled with greater facility.

There are several methods of converting an ordinary seedling tree into one that is more desirable. Those most adaptable to

Philippine conditions are the Pound method of shield-budding and the Gale method of grafting.

In budding the mango select well-matured budwood—that which is still green and smooth and has the buds well apart—from the first, second, and third flushes from the terminal bud. In trimming off the leaf and petiole let about 15 to 20 millimeters of the thick, fleshy part of the petiole remain attached to the bud until it sheds voluntarily, for if the petiole is cut too near the bud, fungi frequently enter the bud through this entrance and destroy it.

The stock is suitable for budding when somewhat larger in diameter than a lead pencil. The buds should be inserted at a point where the bark is green and smooth, *i. e.*, of the same character as the budwood, and the work preferably performed when the plant is in flush. First make a vertical cut about 5 centimeters in length in the stem, and, according to whether the bud is to be pushed up or downwards, make a horizontal cut at the lower or upper end of the vertical cut, trim off the edge of the horizontal cut to facilitate the insertion of the bud and lift the bark by passing the point of the knife gently up and down between it and the wood so that the bud can be inserted without undue pressure and attendant crushing of the tissues. Cut the bud rather large, 3 to 5 centimeters long, taking care not to break or tear the tissues. For this reason it is always well to use a knife made especially for the purpose of budding. (See fig. 1.) In order to obtain the best results it is also essential that the edge of the knife be keen as a razor and that the blade be clean.

After the insertion of the bud into the incision in the stock, wrap the bud firmly, without strangling the stock, with grafting tape; allow the remnant of the petiole to stick out between the strands of the tape and place a square piece of wax cloth, held in place by the tape, above the petiole to protect the projecting petiole from dew, rain and from drying out by the hot sun; girdle the stock about 15 to 20 centimeters above the bud after it is tied. After the bud has “taken,” which usually takes place in the course of two or three weeks, unwrap the tape to below the leaf-bud and prune off the top at the point of girdling. In order to force the buds to grow, look over the plants frequently and rub off all adventive buds.

The above method may be used equally well in the nursery, the field, or in topworking old trees; for the preparation of the latter, see under separate paragraph.

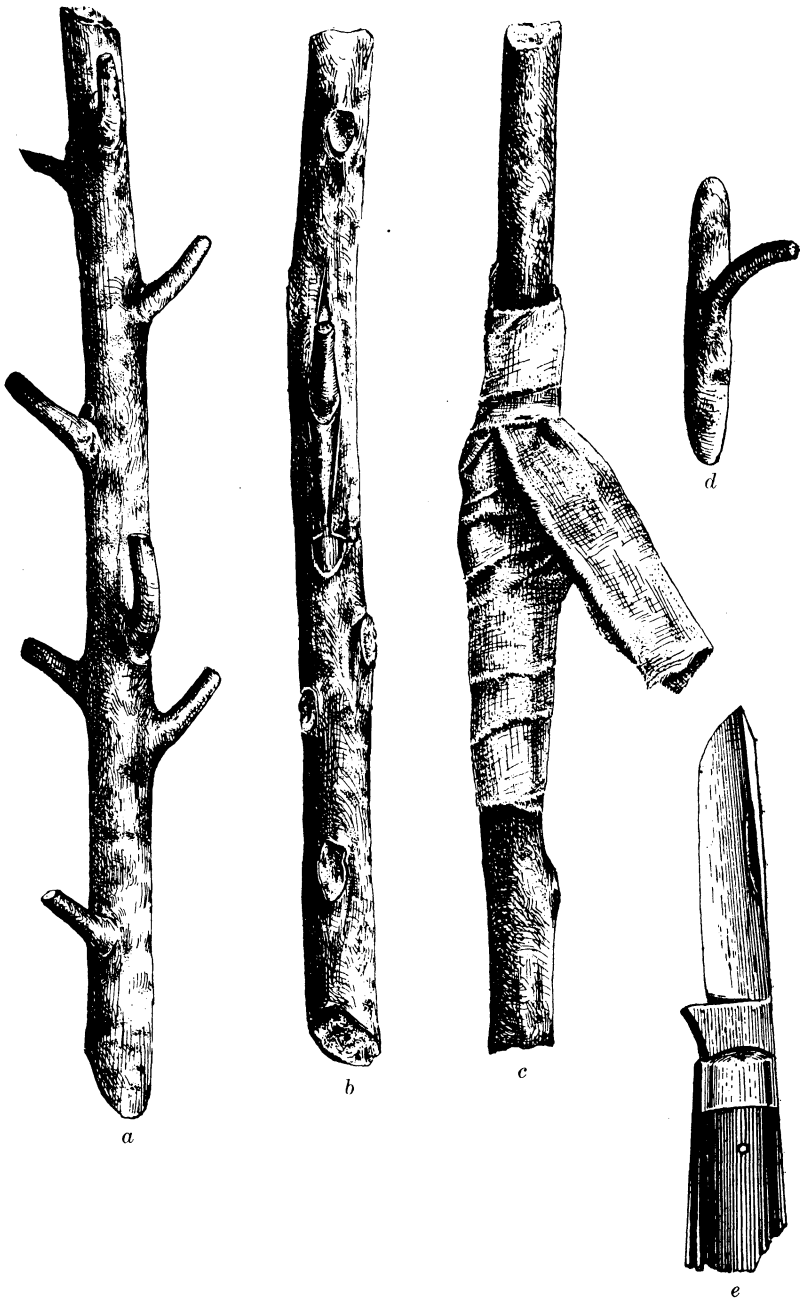


FIG. 1.—The Pound Method of Shield-budding the mango. (a) Budstick, (b) bud inserted, (c) bud tied, (d) bud, (e) budding knife (reduced).

The Gale method of grafting is principally adapted to the working over of seedlings in the field from those six months old to small trees having a diameter of about 5 centimeters; larger trees are *topworked* to greater advantage. Take a scion 30 to 45 centimeters long and, after having removed nearly all the foliage, expose the cambium layer for about 7 centimeters by paring off the bark smoothly with one cut with a sharp knife; perform the same operation on the stock, a few centimeters from the ground; now place the scion so that the 2 cut surfaces make a good fit, tie with grafting tape, and heap moist soil around the stock and scion well above the point of juncture, allowing only a few centimeters of the top of the scion to be exposed above the soil. As soon as a good circulation of sap between stock and scion has become established gradually remove the top of the stock.

TOPWORKING OLD TREES.

In topworking old trees it is first necessary to provide for a suitable "stock" in which to insert the buds. For this purpose prune off the main branches of the tree that are expected to carry the new top about 30 to 60 centimeters from the trunk, and leave the weak and poorly-developed branches to shade the trunk and branches and to maintain the circulation of sap until the new top has formed. In the course of a few months a number of sprouts will issue from the stumps of the old branches of which the strongest should be budded and treated as already described under budding plants in the nursery. When the buds have "taken" and made a good start, gradually remove all other shoots and the branches that were left when the pruning was done until finally the top consists only of the buds inserted. All wounds should be covered with a coat of linseed oil and white lead, or coal tar as second choice, or if these materials are not available, use clay and dung mixed. In cutting off large branches, it is always well to have the cut sloped a little so that rain and dew do not long remain on the cut surface. Never apply so much paint or coal tar that it runs down the limb.

CULTIVATION.

Soils.—The mango will grow on any kind of fairly-drained land not too shallow; it luxuriates on rich moist soils having good drainage and it does not suffer from an occasional inundation. However, a poor soil that is fairly deep is best adapted for the production of fruit. An annual rainfall of 1,250 to

2,500 millimeters mainly occurring from June to October is most suitable for the mango.

Clearing.—In setting out a mango orchard the land should preferably be cleared a year previous to the time when it is planned to set out the trees. If the land is covered with timber the stumps should be removed and the land planted with a leguminous cover crop. The roots of this will open up the soil, add humus and nitrogen, and altogether put the land in good condition before the plants are ready to be set out.

An orchard may also be started by clearing away the timber and largest growth from the ground, after which the land is staked and a circular area cleared around each stake where a tree is to be planted. As the trees increase in size, the circle in which they stand should be enlarged until ultimately the land is entirely cleared.

Planting.—It is well to dig the holes for the trees a few weeks in advance of the time of planting. Make the holes about 60 to 80 centimeters wide and 40 to 50 centimeters deep. In planting the trees fill the holes with surface soil instead of the acid subsoil dug out of the holes, and work in the soil carefully among the roots allowing them to remain in as natural a position as possible. The mango should never be planted deeper than it stood in the nursery. To prevent excessive evaporation until the trees have become established, it is well to prune away about two-thirds of the foliage and all tender growth; it is also of benefit to cut leafy branches and stick them in the ground around the young plant for shade. Mulch the plants heavily.

An orchard may also be established by planting seeds "at stake" where the trees are to remain, with a view to budding the young plants or topworking them after they have become of some size. This method has much to recommend it, particularly for those not well versed in the transplantation of trees and plants. If this method is adhered to it is well to plant 3 or 4 seeds together in each "hill" to insure a good stand; as the seeds germinate all but the best plant is thinned out in the hill.

No mango orchard should be planted out less than 10 meters apart between the trees and a distance of 12 to 15 is preferable. Aside from varietal variation in vigor, the fertility of the land, prevalence of moisture in the soil, and the amount of precipitation are factors that should be taken into consideration when the distance is decided upon, as influencing the development of the trees. It should be kept in mind as well that where it

becomes necessary to combat insect enemies or diseases by fumigation or spraying, the trees should stand sufficiently far apart to permit the work to be executed conveniently.

WINDBREAKS.

The mango is so admirably adapted for a windbreak that to plant other nonfruiting trees with this end in view would be wasting space, for even if some fruit is lost through the exposure to the wind more or less will always mature on the trees. For windbreaks only the most vigorous varieties should be planted.

COVER OR SECONDARY CROPS.

Where a leguminous cover crop is wanted, the velvet bean, Lyon bean, cowpea and related species may be used with good success. Of these the Lyon bean is preferable in the Philippines, since it produces a greater amount of growth per acre here than any other legume.

The seed of the Lyon bean and cowpea should be planted preferably in drills to admit of cultivation until the plants are established. About 20 liters of seed of the Lyon bean is sufficient for one hectare; 180 liters of cowpeas will plant the same area if sown broadcast, or if drilled, one-fourth that amount will suffice.

The considerable distance between the mango trees necessarily leaves much land unoccupied for several years; this may be planted profitably with what is usually called secondary, or catch crops. These may consist of small, quick-growing, early-bearing fruit trees, pineapples, field or garden crops. There is not the slightest danger of their being injurious to the mango trees, provided that the cultivation is not carried so close to the trees that the work animals injure them or the cultivators tear or break their roots; in fact, it is beneficial in that the constant stirring of the soil aids in rendering plant food available to the plant that hitherto may have been unavailable. Among the fruits that may be recommended for this purpose may be mentioned the banana, papaya, the citrus fruits, the sugarapple and related plants, etc. The trees should be planted one in the center of each square, or as many in one hectare as there are mango trees. If the mango trees are planted out at the maximum distances, one secondary tree may be planted between each 2 mango trees and one in the center of the square. Where fruiting shrubs are used as a secondary crop, these should be planted in rows, and may be set out in the interspaces about 1.5 meters apart, maintaining a distance of about 4 meters from a mango

to a shrub; these shrubs being planted in rows between the mangos, they would not for some years inconvenience the planter. Bananas and papayas should be planted about 3 meters apart in the interspaces.

By the growing of secondary crops between the mango trees their cultivation is already provided for during the early stages of the development of the grove.

When the trees have grown large and entered their fruiting stage, leave the land entirely uncultivated during the dry season except for the stirring in of the fertilizer.

FERTILIZERS.

The soil in the Philippines is in general sufficiently rich in all elements for the development of the trees, in fact it seems to be too well supplied with nitrogen and, in consequence, the trees develop top at the expense of fruit. To counteract the influence of this superabundant nitrogen supply in the soil, it seems reasonable to believe that better crops of fruit may be produced by judicious applications of fertilizers containing phosphoric acid and potash when the trees become of fruiting age. These applications should be made from September 1 to about January 1, and not during the spring or summer months.

During the first few years after the trees have been set out, well decomposed stable manure applied to the trees would considerably hasten their development, but when the trees are of fruiting age it is better not to use it except on very poor soil.

USES OF THE FRUIT.

The mango is essentially a dessert fruit, yet it has many other uses. Excellent mango sauce, very similar in flavor to that made from the apple, may be made from the full-grown *unripe* mango. It is prepared by peeling the fruit, slicing the flesh, and boiling it together with a little water, adding sugar to taste.

Jelly.—Peel the mango as it begins to turn yellow, before it softens; slice the pulp from the seed; pour enough water in the pan to cover the fruit, and boil until quite tender; strain through muslin cloth; to this juice add an equal quantity of sugar and boil till it jellies. Lime juice may be added if more acidity is desired in the jelly than is present in the mango.

Marmalade.—The pulp left after the juice has drained off in making jelly is now run through a fine sieve; boil with an equal quantity of sugar, adding a little lime juice to make it firm, until it thickens like cheese. (Marmalade, of course, can also be made direct from the fruit, *i. e.*, with its own juice retained.)

It has been stated that if the mango seed is boiled together with the preserve, the preserve will retain the flavor of the fresh mango. The seed, of course, is thrown out when the preserve is put up in jars.

Mango preserve.—Select mangos just showing color, peel and slice; to each kilogram of fruit, use 1 kilogram of best white sugar and 2 teacups of water; boil the sugar and water until it drops from the spoon very heavy, then pour it over the fruit and let stand until cold; pour off the sirup and boil down as before; when the sirup is quite thick, drop in the fruit and boil hard for twenty minutes, or until the sirup remains thick. Seal at once.

Aside from these uses, the mango may be candied, made into chutney, or pickled.

MARKETING.

Where the fruit is handled properly it seems that its shipping qualities are very good, fruit shipped from the West Indies to England and France, and even from India to London, arriving in good condition. Ventilated crates, 30 by 30 by 60 centimeters, containing a dividing board in the center, and 2 trays of a thin board to distribute the weight, would probably be found to be a suitable package in the Philippines. Great care should be exercised in the handling of the fruit from the time it is picked until it is packed, in order to reduce the number of spoiled fruits to a minimum. Each fruit should be wrapped in soft tissue paper before it is put into the package, and care should be taken to see that no fruit can move about after the crate is nailed up.

DISEASES, AND INSECT ENEMIES.

No serious disease affecting the mango has yet been reported in the Philippines. The different parts of the mango tree are affected by a number of insects, the majority of which do not, however, seriously injure the plant.

At the present time one of the most serious insect pests of the mango is the mango hopper, a small, wedge-shaped insect that inhabits the mango trees throughout the year, and which, as the trees come into bloom in the spring, multiply some years in such large numbers as to sometimes destroy a great part of the mango crop for that season by sucking out the juices of the tender flowerbuds and flowers, which in consequence wither and drop.

Remedies.—On account of its feeding habit, the insect is difficult to destroy without injury to the flowers; the contact sprays in Circular No. 12 are recommended experimentally for the control of this pest.

Another serious pest of the mango in several parts of the world are the fruit-flies, of which there are several species. At least one species exists in the Philippines that does considerable damage; the exact amount of the loss caused by this insect is difficult to estimate from the fact that as soon as the infested fruit drops to the ground it is eaten by the numerous hogs that are present everywhere, and undoubtedly this fact assists greatly in keeping the pest in check.

Remedies.—Gather and burn, or bury, 1 meter deep, all refuse fruits and “drops” under the trees, and where they become especially troublesome, spray the trees with the Mally Fruit-fly remedy. (See Circular No. 12, p. 4.)

It is recommended that the first application of this spray be made a month before the presence of the larvæ in the fruit is expected, and thereafter an application every ten to fourteen days until the flies have disappeared. In the application of the spray, direct the nozzle so that the liquid falls in small drops over and through the tree.

There are two unidentified species of *Lepidoptera*, the larvæ of which work considerable destruction to the mango: One that enters the young tender terminal growth and hollows it out after which it withers and dies; another larva, probably the same species, has also been found to work much destruction to the mango flowers in the flowering season; considerable damage to the mango flowers is also caused by a larva that feeds on the surface of the flower stems with the effect that they shrivel and die. These insects, as yet unidentified, are together with the mango hopper, and the unidentified fruit-fly already referred to on a previous page, the principal and, as far as known at present, the only serious insect pests on the mango in the Philippines. A remedy for the larva just referred to can not be recommended until the life history has been studied further.

For a full discussion of the control of fungi and insect enemies, see Circular No. 12.

O. W. BARRETT,
Chief, Division of Experiment Stations.

Approved:

C. M. CONNER, *Assistant Director of Agriculture.*

NOTES ON FORAGE PLANTS IN JAVA AND INDIA.

By C. V. PIPER,

Agrostologist, United States Department of Agriculture.

Climatic conditions in Java are so similar to those in the Philippines that the Dutch method of feeding cavalry horses becomes of particular interest. At Padalarang there is a large cavalry remount station where a large number of horses imported from Australia is kept in reserve. These animals each receive about 25 kilos of green grass and 5 kilos of palay daily. This ration keeps them in excellent condition judging from their appearance at the time of my visit. The green grass consists of a number of native species, among which zacate so well known in Manila is considered the best. Some Guinea grass grown by natives near the remount station is also used and efforts are being made to increase this supply. Some of the wild grasses, notably carabao or bitter grass (*Paspalum conjugatum*), are usually refused by the horses.

Alongside the remount station is the horse-breeding farm, the object of which is to improve the native horses which are identical with the little trotters so well known in Manila. According to the director of the station, Dr. Groeneveld, these horses are all originally from Sandalwood Island (Soemba) and are, therefore, often called Sandalwood ponies. There are historical records of the fact that these horses were well known three hundred years ago and even then were shipped to the various islands of the Indo-Malayan region. According to Dr. Groeneveld the evidence is also trustworthy that these horses are the descendants of a shipload of Arabian horses. On Sandalwood as well as on Madura there are extensive areas of grass-lands, thus making these islands especially well adapted to stock raising. Most of the beef used in Java comes from these islands. In Java as in the Philippines the constant tendency has been to sell the best horses to the cities, with the consequence that the breeding for the most part was from the inferior animals retained

in the country. The object of the horse-breeding station is to maintain the excellent form and trotting capacity of the native animals and to increase their size by crossing with Australian horses. Many of the native horses used in breeding are exceedingly fine examples—their beauty of form, high spirit, and grace of movements would make any lover of horses enthusiastic. Second-generation crossed animals indicate that the desired object of increased size without diminution of trotting ability will be secured. As fast as possible the cross-bred stallions will be used throughout the country to bring up and maintain the breed.

Dr. Groeneveld has a patch of alfalfa of which he is very proud, and which he has now maintained several years. The alfalfa is planted in rows to permit of cultivation, as otherwise the weeds soon destroy it. The secret of his success is heavy liming of the soil and inoculation, combined perhaps with the altitude, where no great extreme of heat occurs. From Dr. Groeneveld's success I have no doubt that similar results can be had in many places in the Philippines, but it would probably be unprofitable for any farmer except a dairyman, and then only in places where lime or crushed limestone is cheap.

At Karanganyer is a cattle breeding station where there are many fine examples of Indian cattle. The station seems to me not very well adapted to the purpose, as there is very little grazing land in the vicinity and so far as I could learn no cattle industry. The only feed grown is *Panicum numidianum*, a grass very similar to Pará grass. It is quite likely that this grass may prove better than Pará in many places, especially where the ground lacks much moisture. A supply of seed was secured to test in the Southern States and it should also be tested carefully in the Philippines.

The common grass all over western Java is *Polytrias præmorsa*, which makes a close sod like Bermuda and furnishes good pasturage. About Batavia and other cities this is the principal lawn grass in the parks. Its only objectionable feature is its somewhat purplish color. A little of it is now introduced about Manila and it shows a decided tendency to spread. It is one of the grasses that offers promise in improving the pasturage on cogon lands. Cogon by the way is not a very common grass in Java, and in India is decidedly scarce, being replaced by a larger species, *Imperata exaltata*, which also occurs in the Philippines.

In the matter of lawns I was especially impressed with the

excellence of the grass cover in the deep shade of trees at the Botanical Garden of Buitenzorg. The best of these grasses is *Paspalum marginatum*. As some difficulty is had in shady lawns at Manila I would suggest experimenting with this grass.

Conditions in Ceylon, at least in the southern mountainous region, are much like those in western Java, the soil in both cases being reddish. Pará grass, under the name Mauritius grass, is quite largely grown and constitutes the principal green fodder sold in Colombo. I heard no complaint of it being troublesome as a weed, as has been the case in Jamaica and other West Indian Islands.

In India considerable quantities of hay are put up at so-called grass farms. The farm at Saharanpur is typical. The native grass here consists largely of *Andropogon annulatus* and *Pennisetum cenchroides*, though numerous other species make up part of the crop. It is these grasses that are cut for hay just after the monsoons are over in September, and the quality of the product is considered very satisfactory. Besides mowing the grass little is done at these farms, though it is considered advisable to plow them about every five years. No grass seed is ever sown in India so far as I could learn, and the only properly cultivated grass consists of patches of Guinea grass and alfalfa. In the main the roughage animals receive is green feed, wild grass when that is available, and juar (sorghum) during the dry season. For grain feed cavalry horses usually receive a mixture of juar (sorghum) or barley and some bean, either horse gram (kulthi) or Bengal gram (chick-pea). The hay put up at grass farms is in part an emergency ration in case of need in field operations. Where green feed is available it is usually fed as roughage, or a mixture of green feed and hay is used.

None of the numerous wild grasses of the Ganges Valley and other parts of India would pay to cultivate in competition with better tropical grasses, such as Rhodes, Sudan, Guinea, and Pará, but many are of sufficiently high quality to be of great value in the Philippines provided they would spread naturally. Inasmuch as species of *Alysicarpus* (mani-mani) common in the Philippines also occur in the Ganges Valley, and from the further fact that the climatic conditions are very similar to central Luzon, a wet season and a dry season, it is quite likely that these grasses will find themselves perfectly adapted to Philippine conditions. The introduction of aggressive grasses of good quality that can maintain themselves in the cogon lands and better

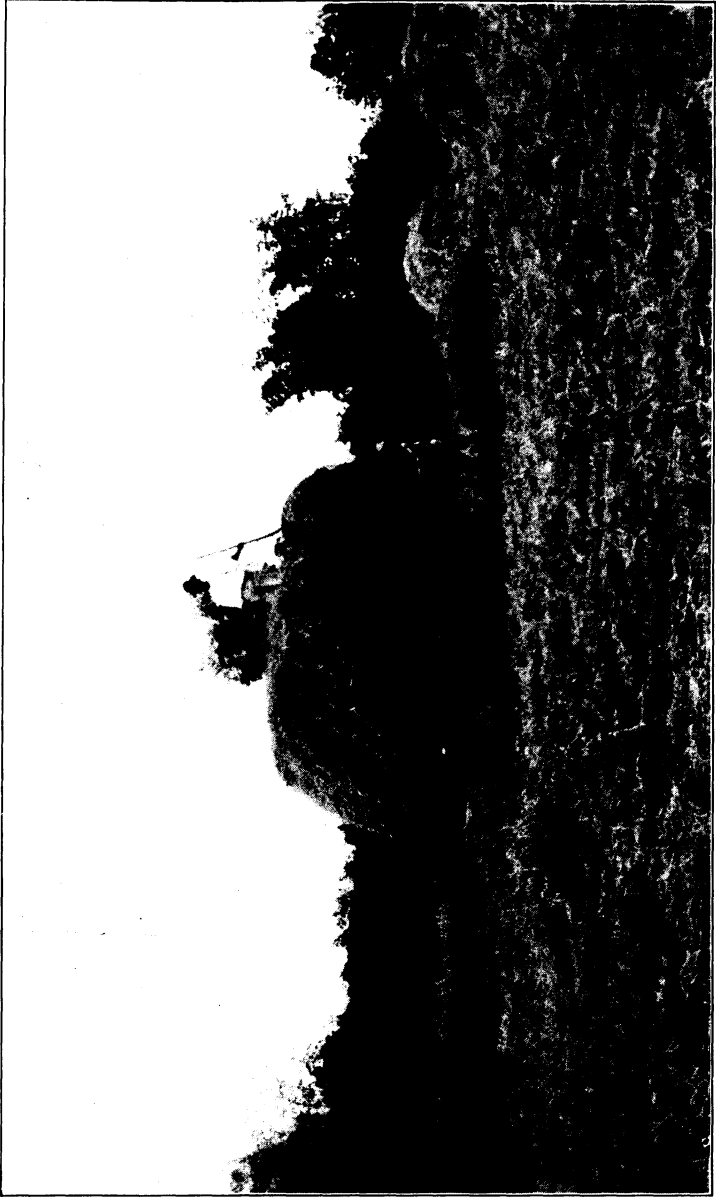


PLATE II.—HAULING RHODES-GRASS HAY FROM FIELD TO BARN.

the pasturage is a matter of great importance and sooner or later one that will require thorough investigation. *Pennisetum cenchroides* would seem to be of especial promise in this connection, but many of the better Indian grasses should be tried.

Juar is the great cultivated fodder crop of India—but only the stalk and leaves are thus used, the grain being a food for human consumption. The fodder is not as good as that of the sweet sorghums, such as Amber and Sumac, and the grain is not as good as maize—so I can see no reason to introduce juar into the Philippines.

The horse gram or kulthi is an annual legume extensively grown after the manner of cowpeas, and the grain forms a part of the concentrated ration of most horses in India. I see no reason why it should not succeed well in Luzon, planted just after the close of the wet season, but whether the yield of grain per acre would be profitable only experiments can decide.

Bajri, or what is called in America *Pennisetum polyanthum*, is much cultivated in India both for the grain and for forage. There is no doubt that it will succeed well in the Philippines, but the fodder is not as good as sorghum. Furthermore, the birds are exceedingly destructive to the grain—to prevent which the native prepares a platform in the middle of his field where he stays all day no matter how blistering the sun may be.

Ragi (*Eleusine coracana*) is also a very important crop in India, furnishing large yields of an inferior grain like millet. The forage is also comparable in value to millet. With scarcely a doubt it will succeed perfectly in the Philippines, but it is doubtful whether the people would take to its culture.

Throughout India the rule is to have fields in mixed cultures, such as juar and cowpea; juar, castor beans and cowpeas; castor beans and cotton; cotton and kulthi or mung; etc. Each of these crops is harvested separately, a matter made possible by the extremely low value attached to labor. Where a legume is grown in the mixture the philosophy of the practice is evident. Where no legume is grown it is claimed nevertheless to be a good practice, as one plant may fail owing to a lack of timely rains or other causes, while the other will survive these mishaps—and a partial crop is better than no crop. Whether there be merit or not in the practice it is one of the most interesting features of native Indian agriculture.

PHILIPPINE KAPOK: A PROMISING NEW INDUSTRY.

By M. M. SALEEBY, *Fiber Expert.*

The kapok tree is widely distributed throughout the tropical world. Here in the Philippines it is well known to any person who has traveled at all extensively through the provinces. The date and other information relating to its introduction here have not yet been determined, but it can safely be said that the tree has been grown here for at least one century, judging from the extent of its distribution throughout the Archipelago. With the exception of Java, where a few regular kapok plantations have recently been started, we seldom see a large number of trees grown in close proximity. Here in the Philippines the trees are frequently to be found growing along roadsides and borders of fields which are planted in some other crop. Only very recently it was reported that several attempts are now being made in different parts of the Islands to start the growing of kapok on a large scale and in a regular and systematic manner.

The fiber which is obtained from the pods is extensively used by the inhabitants of these Islands and other tropical countries for filling pillows, cushions, mattresses, and for other similar purposes. This domestic use has been made of the fiber from a remote period. Its production and exportation on a large scale, however, did not commence until a comparatively recent date when the Dutch in Java first made known to the commercial world the admirable qualities of the fiber. Here in the Philippines, where the introduction of the kapok tree was perhaps simultaneous with its introduction into Java, no attempt had been made to export the fiber prior to 1905; even now it can hardly be said that the fiber is exported on a large scale. The following statistics will serve to show the extent to which this industry has been developed in Java, in comparison—or rather in contrast—with its development here in the Philippines:

EXPORTS OF KAPOK FROM JAVA.

	Tons.		Tons.
1889	1,125	1900	3,500
1890	1,500	1901	3,800
1891	1,950	1902	3,500
1892	1,450	1903	4,400
1893	1,250	1904	4,675
1894	1,625	1905	6,300
1895	1,930	1906	5,875
1896	2,250	1907	8,250
1897	1,875	1908	6,900
1898	2,725	1909	8,000
1899	2,600	1910	7,930

The exports of kapok from the rest of the Dutch East Indies during the year 1910 were 695 tons, which, added to the quantity exported from Java for the same year, makes a total of 8,625 tons for the whole Dutch East Indies.

The exports of kapok from the Philippines are as follows:

Fiscal year.	Quantity.	Value.
	<i>Tons.</i>	
1905	4	P614
1906	13.5	1,652
1907	37	6,842
1908	27	13,590
1909	10	1,194
1910	30	5,804
1911	98	22,648

Yield and value.—Owing to the fact that all the kapok trees growing in the Philippines are given little or no attention and are planted in a haphazard manner, no definite estimate of the yield of fiber can be given. From several observations made by various officials of the Bureau of Agriculture, a conservative estimate of the annual yield of the fiber per tree may be placed at from $1\frac{1}{2}$ to $2\frac{1}{2}$ kilos from trees under seven years of age. After the seventh year, however, the yield increases to $3\frac{1}{2}$ or more kilos per tree. From three to five hundred pods is considered a fair annual yield from one tree under seven years of age. Trees over seven years have been known to bear as many as one thousand pods, but this is considered beyond the average. The pods also vary in size, and while in some cases only sixty pods yielded one pound of clean fiber, in others it took as many as one hundred and twenty, or more, to yield the same quantity. The weight of the seed obtained from the pod is, generally speaking, a little less than double the weight of the fiber. Experiments with a certain number of pods have shown that the yield of fiber varies from 58 to 65 per cent of the weight of the seed.

The principal world market for kapok is Amsterdam, Holland, which is the distributing center for a few other European countries. Australasia and the United States come next to Holland as buyers of this fiber. The fiber is usually sold in the Amsterdam market under three principal grades, namely, extra cleaned, good cleaned (or prime Java kapok), and cleaned (second quality). The latest quotation for the extra cleaned grade was reported to be 50 cents Dutch currency per pound, equivalent to about 85 centavos Philippine currency per kilo. The difference in price between each of the three grades mentioned above ranges from 9 to 13 centavos per kilo. The fiber is sometimes sold with the seed intact and it is then classified as good uncleaned or ordinary uncleaned. The local price of the seed should be in the neighborhood of ₱36 to ₱45 per ton. The Philippine kapok, when properly cleaned, compares favorably with that from Java. Several samples forwarded by the Bureau of Agriculture have been quoted at 15 to 16 cents United States currency per pound (66 to 70 centavos per kilo) for the ordinary grade; with a more careful cleaning of the fiber, it is believed that it will easily bring 18 to 19 cents per pound (79 to 83 centavos per kilo).

The following data will serve to show the gradual rise in the value of kapok during the last decade:

Exports of kapok from the Dutch East Indies.

Year.	Quantity.			Value.	
	To United States.	To Australasia.	To Holland.	Approximate maximum value in U. S. currency per pound.	Approximate minimum value in U. S. currency per pound.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Cents.</i>	<i>Cents.</i>
1890		400	800		
1900		900	1,800		
1901	17	1,430	2,100	6	
1902	75	1,270	1,450		
1903	280	1,130	2,300		
1904	600	975	2,670		
1905	1,520	1,700	2,600	13	12
1906	1,285	1,690	2,270	15	12
1907	1,450	2,610	3,700	18	14½
1908	1,700	1,700	3,050	15	14
1909	1,720	2,280	3,730	14½	12½
1910	1,800	2,370	3,550	16	
1911				18	
1912				20	

Uses.—Among the filling fibers of commerce, kapok ranks first. This fiber is short, brittle, and of great and durable elasticity. The first two render it unsuitable for weaving purposes, but for upholstery and other similar purposes in which elasticity constitutes an important factor, the last quality renders it eminently suitable.

For filling purposes, therefore, kapok now enjoys a wide variety of uses, which are constantly increasing in number as the admirable qualities of the fiber are being gradually and steadily revealed to the commercial world. The two principal uses of the greater part of the product are the following, in their order of importance: First, for filling cushions, mattresses, and other similar articles of upholstery; and second, for buoyant cushions.

For upholstery purposes kapok is preferred to all other filling fibers on account of its great capacity for filling and also its great elasticity. The latter characteristic is demonstrated by the fact that all cushions and mattresses that are filled with kapok will, after the pressure is taken away, resume their previous dimensions. In other words, kapok does not get matted with use, as is the case with the other filling fibers. Its great capacity for filling is shown by the fact that the weight of kapok necessary to fill a certain mattress is considerably less than that of any other fiber used for the same purpose. This is proved by the following table¹ in which is given the weight of several filling materials necessary to fill one single mattress 6½ by 12 feet (2 by 3.75 meters) :

	Pounds.	Kilos.
Kapok.....	17. 6-19. 8	8. 096- 9. 108
Horsehair.....	26. 4-28. 6	12. 144-13. 156
Seaweed.....	33. 0-35. 2	15. 180-16. 192
Wood shavings.....	33. 0-28. 0	15. 180-12. 880
Crin vegetal.....	26. 4-28. 6	12. 144-13. 156
Alpine grass.....	25. 4-28. 6	11. 684-13. 156
Straw.....	28. 6-32. 0	12. 880-37. 720

The use of kapok in buoyant cushions dates back to a very recent period, prior to which cork was almost exclusively used. Now the former is gradually replacing the latter, and it is only a matter of few years when kapok will be used to a greater extent than the latter for this purpose. Until a few months ago, Philippine kapok was generally considered inferior to the Java product, and while small quantities of it have been for several years used for upholstery purposes in Europe and the United States, its use in life-saving appliances was practically forbidden in the United States. Circular No. 226 of the Department of Commerce and Labor, entitled "Regulations of Motor Boats," dated May 22, 1911, specifically required the use of prime Java kapok.

¹ Taken from a publication issued by the department of agriculture in Java, and entitled "What Kapok Is and What it is Used for."

This naturally put the Philippine product out of the market, and consequently a protest against this restriction was made by the Philippine Government, through the War Department, under date of February 2, 1912. The justice of this protest was so plain that the Department of Commerce and Labor at once issued circular No. 236, dated February 15, 1912, which superseded the former and in which it was required that "buoyant cushions shall be capable of sustaining afloat for a continuous period of twenty-four hours an attached weight so arranged that whether the said weight be submerged or not there shall be a direct downward gravitation pull upon such cushions of at least twenty pounds." On receipt of this information, and at the request of the Secretary of Commerce and Labor, two samples of Philippine kapok were sent to Washington by this Bureau, to be tested as to whether they would meet with the above requirements. The results of these tests are given in the answer of the Secretary of Commerce and Labor, from which the following quotation is taken:

Two tests of the Philippine kapok were made in the same manner as tests of kapok in cushions previously submitted.

One pound of the Philippine kapok was sewed up in a cover made of imitation leather cloth, the weight of which cover when submerged in water was about nil, and iron with an actual downward pull of 20 pounds when submerged in water was attached to the cushion and the whole placed in water.

One of the cushions thus weighted floated more than 1 day and 9 hours, and less than 1 day 23 hours 30 minutes. The other cushion floated under the test more than 1 day 8 hours and 30 minutes, and not more than 1 day 23 hours and 30 minutes. The exact length of time that the cushions floated was not determined, for the reason that the cushions were left floating at close of office hours, with no one to watch same.

The two tests show that the Philippine kapok tested fully meets the requirements of the regulations of this Department, contained in Department Circular 236, entitled "Regulations of Motor Boats."

Another use that is destined to influence to a considerable extent the development of the kapok industry is as a filler for bandages in surgical dressings. For this purpose it is gradually coming into favor, for it possesses all the requisites such as lightness, elasticity, dryness, and suitability for dry sterilization.

Conclusion.—The above and other minor uses made of kapok will explain its gradual rise in price. The Philippine planters in general are as yet ignorant of the full merits of this product, and the object of this paper is to show them plainly that kapok, of which large quantities are annually allowed to rot in the fields, can, with comparatively little expense and trouble, be gathered,

cleaned, and marketed at a cost that will allow of substantial profits.

Heretofore, the principal drawbacks to the production of kapok for export purposes have been the ignorance of the producers as to the full merits and value of the fiber in the markets of the world, and also the lack of suitable machinery for cleaning it. The first cause has now been eliminated by this Bureau, and due information has been given to both producers and buyers. As to the second cause, it can be said at present that this has, so far, been only partially provided for. One machine has been in operation for the last few years, and has given fair results; another is now being experimented with, with fair prospects of success; and still another is, we understand, under construction. The plans for this last one have been secured from Java by this Bureau and, at the request of an engineering firm in Manila, turned over to them for construction.

A careful review of the statistics showing the production and value of the Java kapok will conclusively prove that a serious attempt toward the establishment of this industry in the Philippines is justified. The Bureau of Agriculture is well satisfied with the outlook for this industry, and several communications have recently been received by it from a number of manufacturers in the United States who are desirous of handling the Philippine product and who have quoted prices ranging from 14 to 18 cents United States currency per pound, laid down in New York or San Francisco. These facts, together with the facility of raising kapok in the Philippines and its freedom from any dangerous enemies or diseases, should recommend to the attention of the Philippine planters, as well as the Philippine buyers and exporters, the advisability of building up this industry and endeavoring to supply the larger part, at least, of the American and the Australasian markets. The Java product enters the United States market free of duty; and our product must, therefore, for the present at least, compete on even terms. As regards the Australasian market, both Java and the Philippines are also on the same footing; this is no reason, however, why the latter should not be able, in the near future, to supply a large part of the demand in the neighboring British colonies.

NOTES ON THE PROPAGATION OF RHODES GRASS FOR HAY.

By Dr. H. F. HUNGERFORD,
Superintendent Alabang Stock Farm.

Each year there is imported into the Philippine Islands the large amount of 25,000 tons of timothy hay, valued at ₱1,300,000.

It is therefore of the greatest importance to determine whether a satisfactory hay grass could not be grown in the Islands. With this object in view the Bureau of Agriculture undertook the propagation of Rhodes grass, which appeared to be suitable for this purpose.

Rhodes grass (*Chloris gayana*) has been grown with great success in such widely separated regions as South Africa, Florida, Hawaii, and Australia; therefore, there seems to be no valid reason why it should not be produced commercially in these Islands, as its propagation is neither difficult nor expensive. While it prefers light sandy soil and so would be adaptable to the immense plains of central Luzon surrounding Mt. Arayat, it, however, will produce good crops averaging seven tons to the hectare in a season on heavy gumbo soil.

The market price of timothy hay is about ₱89 per ton. Rhodes grass may be produced for about ₱52 per ton, leaving a profit to the producer of ₱37 per ton; with proper care and attention this grass will surely give a comfortable annual income to the grower.

Methods of propagation.—Various methods of propagating Rhodes grass have been tried since the first importation of seed was received in 1911.

In all cases, irrespective of the method of planting used, it should be remembered that owing to the fine nature of the seed, the land must be brought to the finest tilth possible; an abundance of water must be supplied until the plants have become firmly established, and thereafter at moderate intervals.

After a year's experimental work with the propagation of this forage plant it is still too early to state positively the best method of propagation, but a few of the methods tried on the Alabang stock farm may be mentioned.

Probably the best results were obtained by sowing the seed broadcast in plats varying from 10 to 15 meters wide.

The width of these beds will have to be determined by the nature of the soil; where it is loose, friable, and easily "washed," or where the grades are steep, narrow beds are to be preferred; on the other hand where these conditions do not prevail the widest bed possible is the best.

Having located a suitable piece of ground sloping gently in two directions, if possible, the main irrigation ditch is laid out following the greatest slope of the land; next, and at right angles to it, are laid off the laterals, their distance apart determining the width of the plat. The plats between the laterals are now worked up and harrowed over to remove all clods; where the land is of clay and inclined to be lumpy, it may be irrigated, and, when dry, if harrowed, the clods will readily break up.

When a fine tilth has been produced, water is admitted to the main ditch and then to the laterals in small quantities. The lower banks of the lateral canals are opened at intervals and the water allowed to flow into the plats, care being taken that the force is not sufficient to cut channels in the soil. In fact, the water should rather soak through the soil than flow over the surface. (See Fig. 2.)

After the plats have been well soaked (and they should be thoroughly wet, as the seed is rather slow in germinating, and if irrigated before it is well sprouted much of the seed will be lost), the seed is sown broadcast and not too thinly over the plats; it is then raked in with an ordinary garden rake or even a board set at right angles to a long stick will answer the purpose. The seed should germinate in from five to seven days. After it is well started it may be irrigated again, and subsequently as often as may seem necessary.

At first weeds and other grasses should be removed but once the Rhodes grass has taken a firm hold it will shade out all other plants.

Other methods of growing this grass have also been tried, though none are as satisfactory as that already mentioned.

The seed may be planted in rows similar to Guinea grass, the rows being spaced 6 decimeters apart. This allows room for the passage of cultivators and irrigation. This method is

not recommended, however, as the grass grows much more coarsely and is therefore less suitable for hay. Where the grass is already planted in this manner it is suggested that the rows be filled in by transplantation, thus converting the field into a solid mass of the grass. The main ditch and laterals can later be marked out and opened up with a plow.

Rhodes grass may easily be transplanted in a similar manner

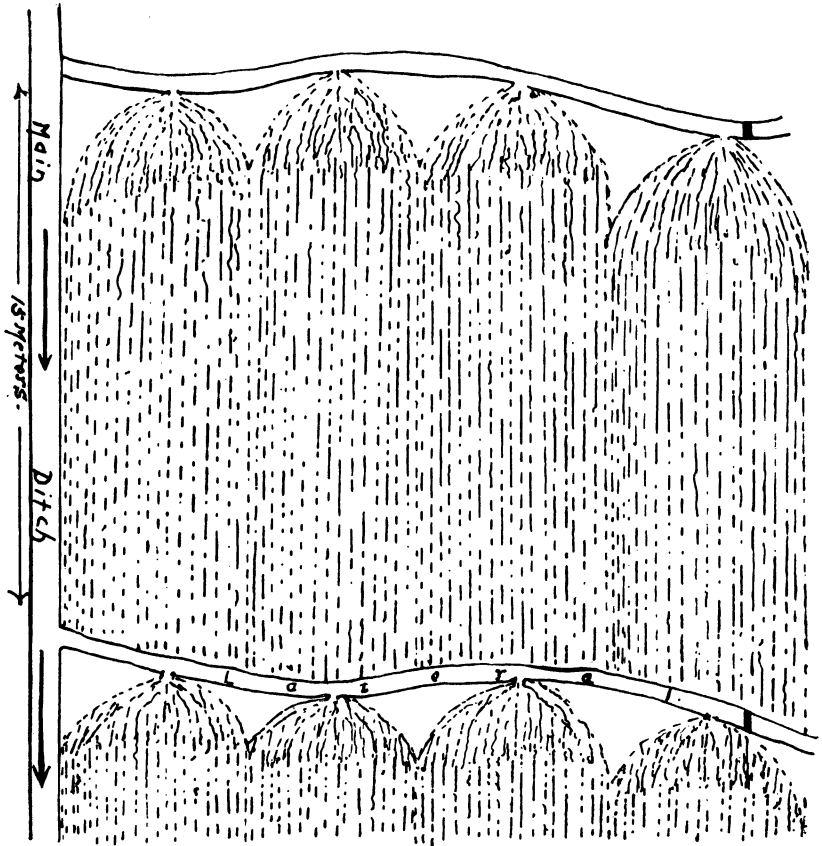


FIG. 2.—Method of Laying Out Main Ditch and Laterals.

to Guinea grass; care should be taken that the holes to which it is transferred are both wide and deep. The ordinary method of making these holes with a pointed stake is most unsatisfactory, as the ground is compressed and hard, and gives the young roots no chance to spread. A mattock should be used, and one stroke should be sufficient to make a hole deep enough for all purposes, while leaving the soil loose. The grass should be

watered at the time of planting and every three days afterwards until it seems to be growing well.

Broadcasting in old disused paddies has been attempted, with most satisfactory results so far, though whether the grass will withstand the constant flooding which is bound to occur during the wet season has yet to be determined.

Irrigation.—Rhodes grass probably demands more water when first planted than Guinea grass, but once started it may safely be said to require much less.

When first planted, if from seed, the ground should be thoroughly soaked, after which the seed is sown; it can not again be irrigated until the seed has germinated and taken a fair hold in the soil. The first few irrigations after germination should be carried out with great care or else many of the small seedlings will be washed away and destroyed. Generally speaking Rhodes grass seedlings should be irrigated every three to five days for the first month, after which every fifteen days is sufficient.

When the plants are transplanted, the clumps of grass are carefully separated out and set in water until needed. They should be irrigated at the time of planting and every three days subsequently until well established, after which once every fifteen to twenty days is sufficient, depending on the season.

Rhodes grass stands the wet season well on fairly well-drained land.

Harvesting.—From the time of planting Rhodes grass takes approximately three months to reach its full growth; two months should elapse between subsequent cuttings. If cut during the first part of January it may again be cut in March and finally in May, thus allowing three cuttings during the dry season in central Luzon.

The proper time for harvesting can only be determined by experience. It may be assumed that as soon as the grass heads out it has reached its maximum growth and is ready to be cut. It however does not present the light appearance seen in timothy when it has reached the harvesting time.

The curing of Rhodes grass for hay requires great care and attention. If it is not sufficiently cured it quickly heats and becomes *moldy*; on the other hand, if exposed to the action of the sun for too long a period, the grass shrivels up and becomes dry and fibrous and unfit for hay. Besides this, it bleaches to a very light straw color, which no doubt would greatly lessen its commercial value.

In regard to the various methods of cutting, it may be said that when the field is planted in belts or bands, the ordinary hay mower can profitably be used; on the other hand, where it is planted in rows, the ground is so uneven that the use of machines is impracticable and so cutting by hand must be resorted to—a rather expensive method. If, however, the intermediate rows have been filled in and care has been taken to level them during transplanting there is no reason why the machine should not be used.

Rhodes grass cut during the day is stacked in small cocks at night. (See Plate I.) Next morning these are again spread out in the sun, care being taken that the grass is well shaken out. It is well to note here that the “manojos,” or handfuls, made by the cutters have a tendency to adhere too closely and do not cure unless opened up. After the grass has cured all day and has been turned once or twice to assure a uniform exposure, it is placed in large cocks for the night. If in the judgment of the haymaker it is now cured, it may be hauled to the barn or it may be exposed to the sun for another half day; more curing than this has in our experience been deleterious in its effects as the hay then begins to bleach. (See Plate II.)

The hay should be carefully watched for a while in the barn to prevent heating. If it is to be baled it is well to turn it all out and shake it up in the sun for half a day before finally putting it through the machine. In this way one can be assured that there are no damp spots, and any slightly moldy spots which may possibly have formed can be done away with.

The yield of Rhodes grass per acre is exceptionally good. Three cuttings from a patch slightly more than 1 hectare in extent gave 7,975 kilos—and this in a year when all crops were below average on account of the long continued drought.

Baling.—For the purpose of baling a steampower baler was used. This works at the rate of about fourteen bales (a little less than a ton) per hour; seventeen of these bales average about a ton. Unless the hay is intended for the market this process is not necessary. The chief advantages are that the hay is more easily handled and that there is less waste, especially where the animals to be fed are in different stables at some distance apart. Also it is probable that in this form less moisture will be absorbed during the wet season.

Cost of producing 6 tons of Rhodes-grass hay.

Plowing, planting and cultivating 1 hectare up to first cutting.....	₱100.00	
Irrigation, 4 men at ₱0.70, for eighteen days (irrigating six times in one season)		50.40
Harvesting, 1 capataz at ₱1.60, and 10 men at ₱0.70, for six days..		51.60
Hauling, 1 man at ₱0.80, 1 team at ₱1, 3 helpers at ₱0.70, for three days		11.70
Baling:		
1 capataz	₱1.60	
1 man feeding machine	0.70	
2 men tying wires.....	1.40	
3 helpers	2.10	
2 men cutting wires and stacking.....	1.40	
1 engineer	1.00	
1 fireman	0.70	
400 pounds coal	2.20	
Wire, oil, waste	4.00	
	15.10	
For three days		45.30
Pumping charges		50.15
Total expenses		309.15
Receipts: 6 tons hay at ₱89.....		534.00
Total expenses		309.15
Profit from 1 hectare (6 tons).....		224.85
Profit per ton		37.47

AGRICULTURAL EXTENSION WORK.¹

Compiled by SAM. H. SHERARD, B. Sc.,
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INTRODUCTION.

Special interest is now felt throughout the world in agricultural extension work. State and national legislators, the managers of the great transportation companies, the officers of boards of trade, residents in towns and cities, as well as educators and educational institutions, particularly the agricultural colleges and experiment stations, and state and national departments of agriculture, all have suddenly come to realize the immediate and paramount importance of the practice of a better agriculture by the great body of farming people. Just now attention is turned as never before toward the discovery of effective and economic methods for accomplishing this end.

DEFINITION OF EXTENSION WORK.

The committee on extension work, in a meeting at Baton Rouge, Louisiana, in November, 1906, gave the following definition to extension teaching:

Extension teaching in agriculture embraces those forms of instruction, in subjects having to do with improved methods of agricultural production and with the general welfare of the rural population, that are offered to people not enrolled as resident pupils in educational institutions.

Agricultural extension work also embraces anything that will improve conditions on the farm or aid in improving the rural population. Extension work connects the farmer with the agricultural colleges and experiment stations and gives to him new things of economic importance that have been tried out and found to be practical on the farms of progressive planters. Through extension work, farmers in thinly populated neighborhoods are brought closer together and learn of the doings of farmers in other local-

¹ From notes taken from the Annual Report of the Office of Experiment Stations for 1910, and from the Report of the Committee on Extension Work, Circular No. 72, of the Office of Experiment Stations, United States Department of Agriculture.

ities. It is a new movement brought about by the wasteful methods of our present agriculture, and it is destined to be of untold value in future national progress.

During the present session of the United States Congress, Hon. A. F. Lever, of South Carolina, will present a bill providing for extension teaching in the United States. The Lever bill provides for Federal appropriations beginning with \$1,000,000 for the first year and increasing at the rate of \$600,000 per year until a maximum of 6 millions has been reached. In order to avail themselves of these sums the States must raise an equal amount.

The bill provides for giving every State \$12,000 per year before any further division has been made, and the surplus above this amount to be prorated among the States on the basis that the rural population of a given State bears to the total rural population of all the States. This money goes to the agricultural colleges and is to be used for the express purpose of establishing and maintaining an extension department and in sending out a trained man who understands the best method of agriculture into every community to interpret and demonstrate the best system of agriculture, and to extend this work from year to year, as the appropriations increase and the men become available, until such a man is permanently located in every agricultural county.

When every agricultural county in the land is supplied with a capable man, which can easily be done within from seven to ten years, the total expense for both State and Federal appropriations will be between 14 and 16 centavos per capita. If this plan increases the farm output 50 per cent, after it is thoroughly introduced, it will increase the value of the output of the farms by at least \$100 per capita.

The Lever bill is the logical sequence of the Morrill Act, the Hatch Act, and other legislation which has created the colleges of agriculture and the experiment stations. These institutions, together with the Federal Department of Agriculture, have been at work for many years and have gathered a vast fund of useful knowledge relating to scientific farming, and building up and maintaining the fertility of the soil. So far, however, this knowledge has not to any appreciable extent come into general practice by the farmers. All agree that the next step in agriculture is extension work, carrying this information into every farming community by means of trained demonstrators.

That which has come upon the United States with such suddenness was felt by older nations years ago and efforts were then

begun to provide for the future food requirements of their growing populations before these populations would have overtaken production and their people be face to face with insufficient means for self-support. In endeavoring to solve the problems that land impoverishment had brought upon them various experiments were tried by different countries with varying degrees of success.

An examination of the present condition of agriculture in European countries, compared with that when attention to better farming first began, shows that there has been great advance and that the limit of production has not yet been reached. The results that have been accomplished in one of the smallest countries of Europe (Belgium), and the methods that were employed in effecting her remarkable advance, have been set forth in detail in a recent publication by the minister of agriculture of that country giving the methods employed in each province, and the rise in price of agricultural lands, and increase in their productive power during the last twenty-five years.

This report is of special interest just now because extension work has been carried on in Belgium long enough and thoroughly enough to show how it affects agricultural conditions and benefits agricultural people. A translation and an abstract of this report have been made by the assistant farmers' institute specialist of the Office of Experiment Stations, United States Department of Agriculture, and is herewith presented in the belief that the experiment in Belgium is well worth consideration by all who are interested in the extension movement in the Philippine Islands.

EXTENSION WORK IN BELGIUM.

Belgium is only 29,456.07 square kilometers in area, and had a population in 1900 of 6,693,548 souls, nearly equal to that of the Philippine Islands. About one-fifth of the people are engaged in agriculture. Their holdings are mostly small, varying from about 0.4047 hectare to 40.47 hectares and over. The agriculture of the country was in a much neglected condition prior to 1885, at which time a method of improvement was adopted that has produced remarkable results. Under this system the average for wheat in Belgium has been raised from 21.333 hectoliters per hectare in 1885 to 33.467 hectoliters in 1910; the average for rye was increased from 20.776 hectoliters in 1885 to 31.860 hectoliters in 1910; oats from 43.455 hectoliters in 1885 to 70.949 hectoliters in 1910; barley from 33.306 hectoliters in 1885 to 50.129 hectoliters in 1910. The number of

horned cattle increased from 1,382,815 in 1880 to 1,817,587 in 1907; hogs from 646,375 to 1,379,462.

The price of farm lands in the same period rose from ₱420 per hectare in the Province of Anners to ₱648, etc. In this same period the home surroundings of the farmers were also greatly improved, the quality of the live stock was much bettered, and a great industry has arisen in market-garden products and in floriculture.

The remarkable improvement in the agriculture of this country is attributable, as has been intimated, to the measures adopted in 1885, whereby the office of extension supervisors was created by the Crown, and the oversight of agriculture in the various provinces was placed under the control of these supervisors. The specific duties and method of operation are explained in the discussion that follows, and are suggestive of methods that might be put into operation in improving agriculture in the Philippine Islands.

Extension supervisors.—The office of extension supervisors was created by royal edict September 26, 1885. The supervisors have for their principal mission the popularization in a practical manner of the knowledge and processes of agricultural science. They put themselves in direct contact with cultivators and give them gratuitously the counsel desired. They perform functions of nomadic (peripatetic or itinerant) agricultural lecturers in their territory and organize annual conferences in at least five districts throughout each section, in order to hold a complete course on some one or other branch of the science or the practice of agriculture applicable to the region. The supervisors are further charged with organizing demonstration or experiment fields in order to give practical instruction to the farmers.

The fields of operation of the extension supervisors were distributed according to agricultural regions, the entire country being divided into six such divisions, three of them being covered by two supervisors each and the other three having one supervisor each.

The chief extension supervisors were appointed by royal edict September 26, 1885, and after installation by the minister of agriculture they entered upon their duties on October 15, 1885.

Under the direction of M. Carluvels, inspector-general of agriculture, and M. Proost, director-general of the rural office, the new service was not long in attaining the highest results.

In 1894, experience having demonstrated that it would be advisable to make the fields of operation of the extension super-

visors correspond to the administrative division of the country, a ministerial decree was issued providing that each of the governmental provinces should be served by an official agriculturist with one or more deputies, the deputy agriculturist to be specially charged with serving, under the direction and responsibility of the provincial agriculturist, a group of agricultural assemblies (civil divisions). The deputy assistant agriculturists fulfill, then, the same functions as the provincial agriculturists. In 1897 the administration decided to place them on an equality with the provincial agriculturists as regards their title and their relation with the central administration and with the public. The royal edict of October 25, 1897, countersigned by the minister of agriculture, provides that the corps of extension supervisors comprise twenty agriculturists. This distribution of the fields of operation of the service according to the administrative divisions is preserved.

A royal edict of December 24, 1898, coordinates all of these edicts and modifies the arrangement in effect at that time concerning the services of the agriculturists. This edict fixes the salaries of the supervisors and provides that in order to be nominated to the office one must have the diploma of agricultural engineer. Exception to this rule may be made with those who have conspicuously proven their knowledge of agriculture and successfully passed an examination before a special jury. There are now thirty-four extension supervisors in Belgium, besides numerous assistants.

The edict of December 24, 1898, defines the purpose of the supervisors as follows:

- (1) To popularize the information and operations of agricultural science, especially by means of oral consultations, conferences, demonstration or experiment fields, etc. They are to place themselves in direct relation with the cultivators and give them, free of charge, the counsel they desire. They are to fulfill the functions of a technical adviser and agricultural lecturer.

- (2) To inform the cultivators of the advantages which they are able to procure through associations, and to furnish precise data regarding such organizations and the functions of the different agricultural groups.

- (3) To enlighten the central administration regarding the work of the official agricultural societies or auxiliaries and their financial encouragement due to the subsidies which they receive and also regarding the honorary distinctions which are to be granted.

(4) To organize and to direct the agricultural courses for adults, courses in horticulture, arboriculture, vegetable gardening, etc.

The organic edict provides for one or more temporary assistants to each supervisor, their duties being to give the agricultural courses and to organize the demonstrations established at the expense of the State. Besides organizing agricultural associations and giving regular complete courses of instruction on a particular subject, the extension supervisors give numerous isolated conferences and talks on subjects of general interest. In 1886 these agents gave a total of 400 agricultural conferences.

The minister of agriculture issued a decree dated September 28, 1885, requiring at government expense the organization of experiment fields under the direction of the supervisors. These practical tests or experiments and scientific demonstrations must include the composition and fertility of the soil, the adaptation or acclimatization of desirable plants, and the employment of improved machinery. The experiments likewise include, according to the region, tests of garden vegetables, horticulture, forestry, apiculture, the care of poultry and of milk, the raising and fattening of live stock, etc.

The number of experiment fields under the control of the supervisors is considerable. In the beginning they were utilized to test fertilizers and new varieties of plants and were largely demonstrative in character. The use of these experiment fields is to-day largely extended, and for the past ten years they have been used more for the acquisition of new knowledge than for the popularization of known facts. Since 1903 uniform and systematic experiments have been organized for each region of the country in order to obtain practical information regarding the fertilizers needed and the influence of thorough cultivation. Experiments on the feeding of dairy cows and the fattening of cattle and hogs have likewise been systematically organized since 1901. When occasion has arisen experiments have also been carried on regarding the diseases of plants. Forecasting the weather has also been conducted for several years by this organization.

The supervisors assist and encourage by giving advice and counsel in the organization of agricultural societies, but do not take part in their creation. In their administrative relation the supervisors are called upon to give advice on all questions relating to agriculture in their territory, such as agricultural statistics, organization and control of agricultural extension instruction, orders of merit, subsidies to agricultural societies, etc.

FORMS OF EXTENSION WORK IN THE UNITED STATES.

Group A, farmers' institutes.—The farmers' institutes are a phase of the itinerant lecture system classified under Group B, but they form so large and distinctive a movement that it seemed wise to put them in a class by themselves. Historically they are the earliest form of organized extension teaching. They have been for thirty-five years the means of disseminating real agricultural teaching. They are supported by large grants of money, are now pretty thoroughly organized, and the institute workers have an association of their own. For these reasons they demand a separate classification.

Group B, itinerant lectures other than farmers' institutes.—Here are listed the lectures and addresses given by members of the agricultural college and station staff and by employees of other institutions, including miscellaneous lectures, regular courses of extension lectures, traveling schools of various types, special railroad trains designed for education purposes, and addresses before teachers' institutes on distinctively agricultural themes. Various minor endeavors, must, of course, also be grouped here.

Group C, literature.—This group comprises those forms of extension teaching developed by means of written and printed material. This literature consists of the great mass of regular correspondence about agricultural subjects carried on through the experiment stations, colleges, boards of agriculture, etc.; also the various publications of these institutions, including station bulletins, regular reports, miscellaneous pamphlets, and the like; correspondence courses, reading courses, traveling libraries, and the publication, particularly by educational institutions, of periodicals dealing with agricultural subjects.

Group D.—This comprises all those efforts in which the particular emphasis is laid on object lessons, or outdoor practicums. This includes such activities as field demonstrations of various operations, such as spraying; coöperative demonstrations in which, because of the nature of the work, it is necessary to have the assistance of the individual farmer, and coöperative tests, as of varieties adapted to different localities. These tests, by the way, are close to the border line between the work of the experiment station and of the extension department, but are classified here because in many cases they are essentially for the purpose of education and not for the gaining of new knowledge.

Education exhibits at agricultural fairs, made by colleges, experiment stations, etc., and attempts to secure visits of inspection to the colleges and stations by farmers and others interested, where these visits are essentially for the purpose of education, also come in this group.

The above four groups, A, B, C, and D, are intended to include all of those forms of extension teaching in agriculture which belong to universities, colleges, and other departments, agencies, or institutions whose work is distinctively and primarily educational.

Group E, on the other hand, was meant to include those aspects of the work of the multitudinous rural societies, as carried out in their meetings and propaganda, which aim to instruct. These may comprise the efforts of agricultural fairs to introduce educational features; programs of the various horticultural, livestock, and other agricultural societies; lecturer's hour in the grange; village improvement societies; civic associations with rural betterment sections; rural study clubs; boys' and girls' agricultural clubs or institutes, such as the Junior Naturalists in New York, the Nature Guard in Rhode Island, etc.; and agricultural students' unions of various types. Rural societies, in carrying out these lines of endeavor, are quite dependent upon the colleges and stations for their material, and oftentimes for the initiative. Nevertheless, the classification is logical, because eventually the work must be fostered and developed by the capacity and persistence of the voluntary organizations themselves.

Group F.—It was meant here to outline a field which is somewhat indefinite in character, but one in which the colleges have a part, together with other agencies. It comprises that form of endeavor which attempts to secure coöperation among various rural organizations and institutions, such as efforts to secure joint sessions between other associations, the organization of associations of teachers and school patrons, the formation of leagues or federations of rural societies for rural progress, the installation of a town room as a sort of social center for the town, etc.

It will be observed further that this entire classification is based, primarily, upon varieties of work to be done, and secondarily, upon types of institutions doing the work. It is an attempt to lay out a logical division of the field of extension teaching.

FORMS OF EXTENSION WORK ACTUALLY CARRIED ON BY AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS IN THE UNITED STATES.

- Lecturing at farmers' institutes.
- Holding normal institute schools for institute lecturers.
- Providing short courses in agriculture.
- Equipping and accompanying railway specials.
- Assisting at teachers' institutes.
- Courses in corn and stock judging given in district centers.
- Lectures in district normal schools.
- Visiting and lecturing in rural schools.
- Holding summer schools for teachers.
- Sending out field specialists to give advice to farmers.
- Preparing courses of study for agricultural high schools.
- Traveling instructors to lecture before granges, farm clubs, etc.
- Equipping and sending out traveling "vans."
- Correspondence (ordinary).
- Preparing and sending out bulletins, reports, and circulars.
- Conducting reading courses.
- Conducting correspondence courses.
- Preparing articles for the public press.
- Sending out model agricultural traveling libraries.
- Conducting and publishing agricultural journals.
- Preparing extension lectures in agriculture for rural schools.
- Conducting agricultural correspondence courses for teachers.
- Organizing and conducting school-garden work.
- Organizing and conducting field demonstrations.
- Holding field meetings for instruction.
- Conducting coöperative experiments in agriculture.
- Providing educational exhibits at fairs.
- Organizing excursions to the college by the agricultural associations and by individual farmers.
- Organizing excursions to the college by associations for teachers.
- Conducting field experiments and tests in coöperation with the railroads.
- Conducting experiments and field demonstrations in coöperation with National Department of Agriculture.
- Conducting experiments and demonstration tests on country poor-farms.
- Lecturing in grange halls.
- Lecturing before women's clubs.

Organizing farmers' clubs, women's clubs, and boys' and girls' clubs.

Organizing agricultural students' unions.

Sending agriculturists to judge stock, fruit, etc., at fairs.

Organizing nature-study work in the public schools.

Organizing societies of farmers in each county.

Organizing agricultural high schools.

Creating departments of extension work in the college.

Making a study of social and economic questions of agriculture.

AGRICULTURE IN THE CATANDUANES ISLANDS.

By E. H. KOERT, *Agricultural Inspector.*

The Catanduanes Islands constitute a group of a dozen or more islands and islets off the coast of Albay Province and form a subprovince of the latter. The principal islands are Catanduanes proper, Panay, Palunpum, Late, and Baguio; the rest are of little importance.

In general the agricultural methods in use here are very primitive. The people are very anxious for improvement but must be shown the advantages to be obtained by modern methods before they are convinced and ready to adopt the new and discard the old.

The exports are hemp and copra; crops for home consumption are palay, corn, camotes, mongos and beans. A large number of plants are also cultivated for use in the preparation of "gulay."

HEMP.

Hemp is generally the third crop that the Catandugñan puts in on a new piece of ground. After the selection of a site locally called "late" his first work is the clearing away of the underbrush and scrub; this effected, the big trees are felled and when thoroughly dry the whole is burned. After burning, the residue is cleared off and if an opportune rainfall happens to occur and the farmer finds himself in possession of seed, mountain rice is planted. This is accomplished by scratching the ground with a stick and dropping the seed into the holes. A slight rain before the rice has sprouted means the loss of the seed on these steep mountain sides. If the rice is successfully harvested camotes are planted as a second crop. During the time that the camotes are growing the hemp is set out, the camotes being gradually replaced by a creeper grass called "smokin;" this has a very luxuriant growth and would bear investigation but is very

little relished by horses and cattle. In course of time if neglected the hemp will be stunted to such an extent by the "smokin" that harvesting does not pay; at this stage the plot is abandoned and a new site selected.

It is a safe estimate to say that not over 30 per cent of the hemp is harvested. The absence of trails and roads is the principal cause, and also the few necessities of the people which can be satisfied only with money.

Hemp production could be greatly increased if the municipal and subprovincial officials were more active and instructed the people so they would appreciate the fact that it would pay them to have the finished product always on hand to take advantage of any temporary rise in price. At the present time it is principally the Chinaman who benefits from any increase in price, as he stores his hemp and waits for a favorable market.

The exports of hemp from the Catanduanes Islands amount to about five or six thousand bales¹ a month. This is aside from the production of the district around Calolbon, which is almost all taken to Tabaco in small native sail boats; the reason for this is the great advantage in price prevailing in Albay Province.

COPRA.

This is a new product in these islands. Even to-day some districts produce little or none but the amount is increasing monthly, and the plantings have been so heavy that in the course of a year or two the output will increase from 200 to 300 per cent. There is a heavy home consumption of coconuts here, the most of which are used in the preparation of the various forms of "gulay."

A very inferior method of planting is in vogue here; the ground having been partially cleared the sprouted nut is laid into a slight excavation made with a bolo, then covered up, and abandoned; when the tree begins to come into bearing a slight attempt is made at clearing, often resulting in the destruction of a large number of trees through the accidental firing of the brush which has been left promiscuously scattered around. A gradual improvement can be seen here and there and it is now possible to find an occasional grove fairly well kept. More intercourse with the people of more advanced provinces would be of material benefit.

¹ 1 bale=126.5 kilos.

RICE.

This staple is not raised in sufficient quantities to supply the small home demand. Lack of knowledge in utilizing the abundance of water and the crude methods of cultivation are to blame for this state of affairs. More than fifteen varieties of rice can be found on the island. A large amount of upland rice is grown. A very dark variety is highly liked by the people and locally known as "paroy itum."

The importation of new seed is of prime necessity as the local rice is so heavily intermixed with the different varieties that an even harvest is impossible.

The greater portion of the imported rice is consumed in the larger centers of population; after the home crop is consumed the barrio people depend primarily on camotes and the various forms of "gulay."

CORN.

Corn or maize is grown to a considerable extent to take the place of rice. It is usually planted after the rice harvest. The land is plowed and harrowed and the corn planted with a small stick and then left without any attempt at cultivation. It is hard to convince the people that they would get a better crop with proper cultivation and more distance between rows and hills, their belief being that the larger number of stalks will produce a larger amount of corn.

The corn is usually prepared for consumption by roasting the ears; a small amount is used in preparing a tasty desert from the flour made by pounding the grains.

INTRODUCED VEGETABLES.

A few words ought to be said with regard to the gratifying results obtained within a short time through coöperation with the schools. A year ago there was not a single home garden in existence; what few native vegetables were raised came from the barrios, being mostly of wild growth. The writer has distributed a large amount of seeds, this distribution being generally made by planting a seedbed in a barrio and making it the property of the entire population; later on with the commencement of school terms the seeds were turned over to the barrio teachers with the understanding that they were to be given to all people who should have ground prepared and adapted to the planting of vegetables. The result has been that American plants can be found in the most remote barrio.

Giving seeds to the people promiscuously in the larger towns was found to be merely a waste of seed as the large number of chickens and animals would generally destroy everything in sight.

The district around Pandan appears to be well adapted to the raising of cabbage, exceptionally fine results having been obtained there. All heads are solid and of good form, though not very large..

A very regrettable circumstance is the lack of appreciation of the people of their own native fruits. The papaya for example is hardly ever eaten. Of the banana there are a number of fine varieties but no cultivation is attempted. After a destructive baguio, it takes months and months before a banana can be purchased. Several varieties of fruits are now being propagated at the Bicol Farm and by the time these come into bearing a proper appreciation of fruit as a food may be realized if the schools introduce domestic science locally and educate the people up to it.

BUREAU STATIONS REPORTS FOR MAY.

LAMAO EXPERIMENT STATION, BATAAN.

A continuance of the various projects, as outlined in last month's report, was carried on during May. Budwood of the following varieties of citrus fruits was received at the station May 6.

<i>Citrus nobilis</i> × <i>Citrus decumana</i> ,	Sampson tangelo.
<i>Citrus decumana</i>	"March."
<i>Citrus decumana</i>	"Triumph."
<i>Citrus limonum</i>	"Valencia."
<i>Citrus aurantium</i>	"Pineapple."
<i>Citrus aurantium</i>	"Washington navel."
<i>Citrus aurantium</i>	"Jaffa."
<i>Citrus aurantium</i>	"Ruby."
<i>Citrus limonum</i>	"Clarke."

Budwood of two lots of the biriba (*Rollinia orthopetala*) was also received and budded.

All these varieties are making satisfactory progress.

On May 10, two thousand pineapple slips of the Cayenne variety were received from Hawaii. They were planted in beds 3 meters wide, six rows to each bed, and the slips set 60 centimeters apart in the rows. Paths 180 centimeters wide were made between the beds, thus making it easy to cultivate the plants during growth, and also to harvest the fruit when mature. This system of planting pineapples is employed quite extensively in Florida. It is believed that the introduction of the Cayenne variety and others on the way will mark a new epoch in Philippine pineapple culture.

May 23, Mr. H. H. Boyle, assistant horticulturist of the Bureau, brought budwood of a superior avocado received by the Bureau from California. This is the second lot of avocado budwood successfully introduced into the Philippines by the Bureau of Agriculture. A section of the station will be devoted exclusively to the avocado in the future.

The testing of legumes, begun last year, is being continued this year and about one hundred varieties are being planted in plots, ranging from 100 to 1,000 square meters each. The object is to determine the relative value of each as a cover crop, forage crop, green manure, or the value of the pods and seed used as a vegetable. One planting of the legumes is now being made, and later, about August, a second planting will be made.

During the month the anonas and avocados have been very seriously attacked by mealy bugs (*Pseudococcus* sp.), and the red spider has caused some damage to the citrus trees. Kerosene emulsion and resin wash have been used effectively in their control. The resin wash appears to be particularly valuable in the extermination of the mealy bug. (*F. C. Kingman, acting superintendent.*)

LA CARLOTA EXPERIMENT STATION, OCCIDENTAL NEGROS.

Since our last report 198 millimeters of rain have fallen at this station, the major part coming during the latter half of the month. Until the middle of the month less than 25 millimeters fell.

Approximately 8 hectares of land have been given a second plowing.

Our 5 hectares of experimental plats, 4.5 hectares of corn, and 2 hectares of Guinea grass, have been cultivated and hoed.

Five small plats of sorghum were harvested. These produced very fine heads of grain, but the balance of the plants would have been useless for fodder owing to plant lice.

During the month we have planted eleven varieties of abacá which Mr. Saleeby brought from Leyte, 0.4047 hectare of soy beans, a few plats of mongos and chickpeas, 4.5 hectares of corn, 0.04047 hectare of Sudan grass and some garden vegetables.

Eight varieties of Mindanao abacá were transplanted from boxes to the nursery.

To our herd of horses have been added four mestizo colts, two males and two females. The males were sired by native stallion L-53 and the females by native stallion L-29. They are all doing nicely.

Our Indian mestizo cattle have been increased during the month by two calves, sired by L-31.

One calf has been added to the carabaos.

No increase has been noted among the goats.

We have lost one Berkshire sow.

The work of eradicating lantana has been discontinued until later in the year when we hope to be able to uproot the last bush on the farm.

Many of the gawai-gawai fence posts which we placed late last year failed to grow owing to the unusually dry season which followed. Replacing these posts will occupy a good portion of our time during the coming month. (*H. J. Gallagher, superintendent.*)

THE BICOL FARM, VIRAC, CATANDUANES.

With respect to breeding, May will probably be the second best month for the season. The combined total of the number of mares bred at the Bicol Farm and at the station at Bagamanoc to date is in the neighborhood of three hundred. The estimated total for the two stations for the year is three hundred and fifty at the Bicol Farm, and two hundred at Bagamanoc; this is exceptionally good for the latter place as there are only some three hundred and fifty mares available, and this is the first year of breeding at this place. On account of an outbreak of disease in the jurisdiction of Pandan no animals from there are permitted to be brought into the jurisdiction of Viga.

A report of an outbreak of rinderpest in Viga reached the writer on the 8th of the month, and upon receipt of the proper instructions, an investigation was made of the cattle and carabaos in the entire municipality of Viga and all were found in excellent condition. The report was caused by the death of two calves from diarrhea, and three head that had died by violence, and the caretakers tried to protect themselves by misinforming the owners.

On this trip was seen for the first time the large extent of pasture available on the east coast of the main Island of Catanduanes and on the smaller Island of Panay.

During the month a large number of castrations were performed by the undersigned and several were also effected in the north. The municipality of Calolbon is working hard to effect through moral persuasion the castration of all inferior animals. If this can be kept up the native stallion will be practically eliminated from the breeding question.

The drought is beginning to seriously affect the upland pasture. At the Bicol Farm all planting has had to be discontinued on this account. The only plants able to withstand it are corn, Guinea grass, and *Phaseolus aconitifolius*; the latter does exceptionally well where there is a good deal of limestone.

The municipal council of Calolbon has recently adopted a resolution providing for a trimonthly meeting of councilmen, tenientes of barrios and citizens in general for the purpose of having lectures on hygiene and agriculture and horticulture, the municipality to pay all expenses of the district health officer and the undersigned, who have both been requested to attend and take charge of what pertains to their respective lines of work. (*E. H. Koert, in charge.*)

CURRENT NOTES ¹—AUGUST.

A NEW BRANCH OF THE CITRUS INDUSTRY.

One of the common and cheap bases of perfumes is oil of petitgrain; this is made by distilling the leaves of the wild, or bitter, orange. At present a large part of the world's supply of petitgrain comes from Paraguay, where the wild orange trees are so abundant and vigorous that the leaves can be gathered in vast quantities at all seasons of the year.

Although it requires some 200 or more kilos of the leaves to produce 1 liter of the pure oil, the value of this is so high, and the cost of the labor so cheap (about ₱0.50 to produce 10 kilos of the raw material) that a considerable profit is realized.

We are beginning to believe that the Philippine Archipelago is the home of several, if not actually all species of Citrus, and we challenge the world to show any more vigorous and healthy specimens of that genus than can be found here in these Islands. Of course, like most other crops, the Filipino planter gives the orange little or no real cultivation, but if a fair share of the waste ground in the Philippines were planted with suitable varieties of citrus, we believe Paraguay would have to look to her laurels in the matter of orange-leaf-oil production.

In this connection, we understand that very interesting experiments have already been made here with the object of determining the practicability of extracting oil from the peel of the naranjita and other Philippine citrus fruits, thus permitting the utilization of all unmarketable fruits—a by no means unimportant matter in several districts of Batangas, where it appears that immense quantities of the fruit are from time to time wasted. (*O. W. Barrett.*)

HYBRID ANONAS.

In 1907 and 1908, the writer, then connected with the subtropical garden, Miami, Florida, of the United States Department of Agriculture, in the course of his tropical-fruit investigations

¹ Original notes prepared by various members of the Bureau of Agriculture.

discovered the proterogynous and entomophilous character of the cherimoya (*Anona cherimolia* Miller), the sugarapple (*Anona squamosa* L.), the custardapple (*Anona reticulata* L.) the sour-sop *Anona muricata* L.), and the mamon (*Anona glabra* L.). Simultaneously experimental hybridization work with these species was also begun and the cherimoya and sugarapple, the cherimoya and mamon, the mamon and sugarapple, and the sugarapple and custardapple were successfully hybridized.¹

All these species except the cherimoya are well adapted to all parts of the Tropics. The cherimoya would seem to be subtropical rather than tropical, for while the semitropics in both hemispheres, in Florida and California, France, Spain and Italy and Queensland, Australia, it fruits near the sea level, it is a notable fact that it fails to do so in the Tropics except in the highlands, and this perhaps explains the fact that the Spaniards failed to introduce the cherimoya in the Philippines, where the Spanish civilization was confined largely to the lowlands of the Archipelago.

It seems a pity that the cherimoya, the most esteemed of all the Anonas, should be thus barred to the real Tropics. However, if the low elevations are not adapted to the cherimoya we may in the future find a good substitute in the new hybrids. The writer brought seeds obtained by crossing the cherimoya and sugarapple from Florida to the Philippines in March, 1911, and the seedling hybrids, grown within 2 meters of the tide-water in Manila, have in one year made a growth of about 2.3 meters and are remarkably vigorous and thrifty. The male parent is in this case dominant in all the hybrids—about thirty—to an extraordinary degree with respect to their foliage characters, in fact anyone not familiar with the history of the plants would without hesitation pronounce them to be cherimoyas. The fruiting of these hybrids will be awaited with much interest. (*P. J. Wester.*)

AGRICULTURE IN AFRICA.

Although one of the last countries in the dark continent to become interested in agronomy and stock raising, Benadier has finally awakened and bids fair to become a rather promising region. Notwithstanding the very light rainfall which prevails throughout the coast areas of Eastern Central Africa, Benadier possesses several very rich valleys, and by constructing dams

¹ Wester, P. J., Pollination experiments with Anonas, Torrey Bot. Club, 37: 529-539, 1910.

more or less irrigation can be carried out through the long, dry season. The native Somalis prefer cattle raising rather than any line of crop work. This preference originated in pre-Italian times when pillaging and intertribal warfare was the order of the day, as sheep and cattle could be moved at short notice to safe retreats, while the maize, kafir corn, cotton, etc., would needs be left behind to fall into the hands of the enemy.

Because of the great extent of pasturage in the valleys and the low rate for native labor, the cattle industry bids fair to be very lucrative. Camels, asses, goats, and sheep are also raised very cheaply in Somali Land.

On the other side of the continent, German Southwest Africa is recently making great strides in sheep raising. Two very distinct types of sheep are in evidence there: the "Bocky" which is known throughout South Africa as a very fine mutton sheep, and the Australian wool breeds. The old "Bocky" is probably descended from the fat-tailed sheep of Zanzibar; a few individuals of the latter breed have just been introduced into the Philippines, and are said to be doing well in Masbate. This being a distinctly tropical breed of sheep, the animals do not suffer as much from the heat nor is there so much danger from fly maggots as in the case of the merino, or long-wool, breeds which have not succeeded well here thus far. In the southern portion of the colony cattle breeding is becoming decidedly profitable. (*O. W. Barrett.*)

INTENSIVE FARMING.

Comparisons are said to be odious, but if the average Philippine farmer could be made to realize the possibilities of intensive farming, this country would undoubtedly soon enter upon a new era, and would avoid some of the adverse criticisms that are sometimes made upon its progressiveness along the lines of agronomy and horticulture.

For instance, in the Canary Islands, Madeira, and the Azores, the farms, which by the way, are of only 1 to 2 hectares in size, are made to yield many times the crop material which the same area usually produces in this Archipelago. With the high degree of economy and thrift practiced by the inhabitants of those countries, the soil is kept at "high pressure," so to speak, and never given more than a few days' vacation during the year; one crop follows another immediately; no weeds are allowed to interfere, and the planter, realizing that he has to make himself independent of the climate, provides cheap but effective systems

of drainage and irrigation; and last, but not least, he provides cement-lined stone reservoirs to obviate all drought troubles. Another original, if not brilliant and very economical idea, is the common utilization of *fences for irrigation trenches*; that is, the necessary and numerous stone walls are provided with cement-lined grooves on top, and these grooves lead the water to the vicinity of the cultivated plat where it is turned off from the fence groove to the ground. This system, of course, avoids wasting precious space with ditches and canals, and also avoids the danger of such trenches being damaged by heavy rains.

In the Canaries, seven hundred bunches of Canary Island, or Chinese, bananas may be produced annually on 1 hectare of these thrifty farms; and the potatoes, tomatoes, pineapples, cherimoyas, etc. grown with such care—and incidentally profit—are famous throughout Europe for their excellent flavor, great size, and appearance of being *well bred*, so to speak. (*O. W. Barrett.*)

STILL ANOTHER NEW INDUSTRY.

The snakewood, or nux vomica tree, has been considered until very recently a strictly forest, or at least wild species, but the commercial status of the rare product having improved somewhat, attempts are now being made to bring this crop under domestication. At present most of the supply comes from southern India, though Cochin China possesses rather large areas in which the natives collect seeds desultorily, according to the demands of the market. The price of the seeds varies from about ₱0.05 per kilo for the first-class, well dried, and grades down to ₱0.03 per kilo, for the weak, light-colored "buttons." By the way, this seed, the source of all strychnine and nux vomica compounds in medicine, is one of the most beautiful, in my opinion, in the whole realm of botany. Its exterior is closely covered with silvery appressed hairs, which appear at first to be a glossy, velvety film; in fact, the seeds, after being washed from the plum-like fruit, and dried in the sun, resemble satin-covered dress buttons.

Should the present experiments in Dekkan succeed, there is no question but that this crop could be profitably grown on the hillsides of northern Luzon. (*O. W. Barrett.*)

LIMA BEANS IN CEBU.

Cebu, the most densely populated of any of the large islands of the Philippine group, is confronted at all times with the problem of producing on its farms an adequate supply of food.

Corn and rice, the principal food crops of the province, are largely grown throughout the island, but it is highly important that these crops be supplemented by others of known value. At the present time work is being carried on in Cebu by the Bureau of Agriculture, the Bureau of Education, and the Philippine Railway Company not only to improve the crops already grown, but also to introduce new crops. In a recent communication Mr. Carl F. Coppage, supervising teacher in the municipality of Argao, furnishes a brief statement of work done with Lima beans. The results obtained, as shown in this report which is published herewith, indicate that this crop is one worthy of more extensive trial in other parts of the Islands.

A small plot of Lima beans was planted about October 15, 1911, in a clay loam soil. The ground was spaded to a depth of about 10 inches, and beans planted in hills about 80 centimeters apart each way.

When the plants were well up they were thinned to two in each hill and bamboo poles placed to support the vines. After this they received no other cultivation than such as was needful to keep down the weeds. The past season has been the driest known here for years, and there has been scarcely any rain in Argao since January 1.

I have harvested these beans continuously since about January 15 and now (May 27) the vines are covered with blossoms and fruit in all stages of development.

No estimate could be made as to yield per acre or hectare that would be in any way accurate, but I have seen these beans grown in the United States and am convinced that the yield here is much better.

Another experiment was made in a sandy soil about 80 feet from tidewater. A few beans were planted near a stone wall about February 20, 1912. When they were a few inches high some bamboo poles were placed so that the vines could get to the top of the wall, and no other attention was paid to them. On my return to Argao I found these beans bearing fruit and doing fairly well, though not so well as the ones planted in October.

These experiments have been crude, and were made in the hope of getting some food crop that would do well on such worn-out soil as we find here in this municipality. They will be continued throughout the year in different localities and soils, and more accurate data kept.

No plant enemies, so far as I know, have attacked any of the plants.

If this variety of bean will be able to stand the wet season moderately well I am convinced that it will be a valuable addition to the food crops here in Cebu.

(H. T. Edwards.)

NEW TEAS.

Long before coffee came into use as a beverage, and probably previous to the discovery of tea in China, the Arabs possessed a stimulating beverage called khat, or kafta, known to science as *Catha edulis*.

In many ways the khat plant is equal or superior to either

coffee or tea. It is a hardy shrub growing 2 to 4 meters high, and both the leaves and branches contain a stimulating principle analogous to caffeine. Recently Europe has taken a new interest in khat, and there is a probability that a demand for this new old tea will rapidly increase. It is probable that not a single plant of this species exists in the Philippines, but if some *were* planted here, and if the public taste *should* demand this product, there would be no question as to the advisability of trying out the khat crop here.

At Singalong experiment station a very fine specimen of maté (*Ilex paraguayensis*) can be seen. This famous "tea" of Paraguay and southern Brazil is supposed to be very difficult of propagation and very few specimens of the species are found in the botanical gardens of the world. The maté shrub at Singalong is some six or eight years old and is growing so rapidly that it will soon be a tree fully as large as those of its native habitat. Some twenty million people are now using maté in preference to any other beverage, and a considerable quantity is exported from South America to Europe, although the article is practically unknown in the United States. Personally I prefer maté to any kind of genuine tea and believe it will eventually become a staple article of commerce throughout the world. If we could only create a demand for it here, with this proof of its wonderful adaptability to Philippine conditions, it is more than probable that first-class yields could be obtained. The Singalong specimen would now probably yield twenty times more of the raw product than a Japan or China tea plant. (*O. W. Barrett.*)

WHALES AND COCONUTS.

In certain lines of a few industries, whale-oil competes with coconut-oil. And while there are certainly great profits to be made in the manufacture of coconut-oil, it is doubtful if any business connected with animals or plants yields a greater profit, everything considered, than the whale industry. The writer has a case in mind of a company that was said to have paid 40 per cent dividends the first season, and that after the erection of the plant for trying out oil, drying and grinding the flesh, and utilizing the bones, besides the harpooning launches. In one station (Durban, Natal) it was an ordinary day's work to bring two or three 15-ton or 20-ton whales to the slaughter boards six days in every week.

An employee of this Bureau has seen as many as fourteen whales at once in the Sulu Sea. Why could there not be estab-

lished somewhere in the southern islands a floating factory similar to those being established in Brazil and on the Pacific Coast of the United States for handling sharks, whales, porpoises, and fish in those regions? In one of the Sulu Islands there is a lucrative industry at present which consists in catching sharks, removing their fins and merely drying, baling, and shipping this material for the justly famous Chinese shark-fin soup.

Thousands of the estates in the Visayas and Luzon need organic fertilizers, and whale-meat meal is now considered one of the best animal fertilizers known; shark-meat meal would be equally as good. The dried and ground flesh should be worth in Manila about ₱70 per ton. The bone meal is now worth ₱85 per ton here.

Japan, our neighbor on the north, is succeeding extremely well with her new whale industry; in fact, Japan has even beaten the Norwegian whalers at their own game, having perfected methods of catching and "dressing" these animals which are even more economical than the supposedly perfect methods in vogue in all other countries; it is now possible to buy canned whalemeat at an absurdly low figure, hence that nation is no longer obliged to depend largely upon fish for its animal food. Here in the Philippines, however, we have neither whaling stations nor rumors thereof, and worse still no list of the probably numerous kinds of whales found here, nor definite knowledge of their breeding and feeding habits, numbers, etc., which would be valuable to both the zoölogist and the money-hungry merchant or manufacturer. (*O. W. Barrett.*)

EGG POWDER.

The world needs vast quantities of egg powder. German China is producing it. Tsingtau is now producing something like two million dozens of eggs annually; and about 3,300 dozens per day are put through a new drying process. It is said that the plant is run by electric power and that the vacuum method is used to prevent danger of overheating the delicate albuminoid substances. Improvements have been made so that the yolk can be dried in flakes in the remarkably short space of *fifteen seconds*, ready for grinding and yet keeping the natural color and fresh odor. The "whites" cannot be dried so rapidly on account of their more delicate composition; these are put up in both powder and granular forms.

The up-to-dateness of the Tsingtau egg-powder plant is evidenced by the fact that even the shells of the eggs are crushed and

shipped home to Germany, where the article is in great demand among poultry raisers.

Why doesn't some one indulge in calculating the profits of poultry raising in the Philippine Islands? (*O. W. Barrett.*)

A NEW KIND OF EXPOSITION.

Fairs and expositions are becoming so popular and of such real value to the public that the American Manufacturers' Export Association of New York, has decided to try a new scheme for advertizing American goods, and thus to develop a demand for same in Latin American countries. A ship of 14,000 tons, the *Exposition*, will begin its first tour about October 1, visiting the principal ports of Central and South America, completing the tour to San Francisco in about one hundred and eighty days. This ship will have exposition booths and show cases for display of all sorts of American manufactures and products. Machinery will, of course, be given special attention, but dry goods, drugs, and food products will be very much in evidence.

There is not much doubt as to the splendid success of this novel idea, and the best of the matter is that a similar cruise among the trade centers of *the Orient* is planned at the conclusion of the Latin American tour. It will be a great day for Manila when the *Exposition* comes here. (*O. W. Barrett.*)

CARABAO IN EUROPE.

The carabao is now a subject of thremmatological interest in Transylvania, eastern Hungary. The variety of "water buffalo" of that region is extremely hardy and somewhat larger than our Philippine animal; in fact, adult specimens are said to be commonly met with 1.6 meters in height at the shoulder. The color is a dull black, or black with a white patch on the forehead. Albinos are occasionally met with, of course. The forequarter is considerably heavier than the hindquarter, and the animal is said to be comparatively quick in its movements. During the winter the animals, very naturally, have to be protected by sheds.

It is claimed that the work done by a Transylvania carabao is 40 to 50 per cent above that of a first-class ox. An ordinary animal costs there in the vicinity of ₱150.

Several districts of Italy have used the carabao for many years with good success, the animals reproducing there slowly but surely. Eastern Hungary, however, represents the most northern range of this queer old draft animal. (*O. W. Barrett.*)

THE CHERIMOYA IN CALIFORNIA.

Another of the tropical or rather subtropical fruits heretofore rather neglected is slowly but surely coming into its own. The Pomona College Journal of Economic Botany, Volume II, No. 2, 1912, contains an interesting paper by F. W. Popenoe on the status of this tree and related species in California. As far as is known, the cherimoya was introduced into California in 1871 and has spread until it is now rather common in many parts of the state which are adapted to its culture. However, the cherimoya, in common with so many other tropical fruits, has in California been propagated mostly from seed with the inevitable result that only a comparatively few trees produce really superior fruits. In fact only one variety, the "Golden Russet," is propagated vegetatively at present in California, which variety, by the way, was successfully introduced last spring into the Philippines. The soursop, custardapple and sugarapple do not succeed in California according to Mr. Popenoe, being too tender. The paper referred to is accompanied by many interesting photographs. (*P. J. Wester.*)

BUREAU OF EDUCATION CORN-GROWING CONTESTS.

In Circular No. 65, series 1912, issued on June 13, 1912, the Director of Education has outlined the conditions governing a corn-growing contest that is to be held in each school division. The general object of this contest is to further the growth and use of corn, thereby bettering the food supply of the people of these Islands, and preventing a shortage in the food supply of the Philippines.

Two different contests will be held: Contest No. 1—To determine the largest number of kilos of husked and cured ear corn produced from 100 square meters of land; Contest No. 2—To determine the grower of the best five ears of corn. These contests will be purely school affairs, and the number of entries will be limited.

Contest No. 1 is open to any primary or intermediate pupil of the public schools. Each contestant must without assistance other than plowing the field, prepare, fertilize, cultivate and harvest the products of 100 square meters of land planted to corn. The corn plots must be under the regular supervision of a teacher, and should be at the home of the pupil. All entries should be made by September 1, 1912, and the contest will close on or before March 1, 1913. A "Corn-growing contest card" must be kept for each contestant. Contest No. 2 is open to

any pupil who is either enrolled in contest No. 1, or who is doing gardening as a regular industrial requirement.

A summary of the information contained on the face of the corn-growing contest cards will be submitted to the general office of the Bureau of Education with a report concerning the enthusiasm, difficulties, results and recommendations in connection with either of the corn contests. It is not the intention for the corn-growing contest to take the place of or in any manner curtail the regular garden work in the schools. (*H. T. Edwards.*)

A NEW TEXTILE INDUSTRY.

From the London Chamber of Commerce Journal we learn of a new invention that is said to be causing considerable excitement in the textile world. This consists of a treatment of straw whereby it is possible to produce therefrom a fiber suitable for spinning. If the claims for this new invention are not overstated, the influence of this new material will be far-reaching.

The principal advantages claimed by the inventors are that the new fiber has all the merits of the yarn now produced, that the cost is only one-half that of similar products, that the weight is only 60 per cent of other fibers, and, of course, that the goods are in every way desirable. It is said that experts who have examined this material are agreed as to the truth of the above claims. (*P. J. Wester.*)

FILARIASIS (THREAD WORMS) OF FOWLS.

The trouble becomes apparent by swellings about the head and the joints of the limbs; these swellings are usually painful, the ones about the head occurring in the tear ducts. Where the filarias occur in large numbers the birds frequently die.

Treatment.—By means of a small glass-barreled syringe fitted with a small needle, inject into the swellings eight to ten drops of the tincture of iodine. Usually one injection is sufficient but if necessary it may be repeated in about a week.

It should always be borne in mind in handling fowls of any kind that scrupulous cleanliness is absolutely essential to success. Clean fresh drinking water and clean food should always be provided, and the drinking vessels should be cleaned daily. It is good practice to spray the runs, pens and roosts frequently with a 5 per cent solution of carbolic acid to which has been added chloride of lime in the proportion of 4 ounces to the gallon. This should always be done when filariasis makes its appearance. (*Dr. G. S. Baker.*)

ERRATUM.

In the article upon the Bureau of Health exhibit at the Exposition of 1912, appearing in the April number of THE PHILIPPINE AGRICULTURAL REVIEW, line 9, page 182, the following statement was made:

The presence of 4 per cent or more of phosphorus pentoxide is considered sufficient to class the rice as unpolished and acceptable.

This statement is incorrect as the line in question should read:

The presence of *four-tenths of 1 per cent* or more of phosphorus pentoxide is considered, etc.

MONTHLY VETERINARY REPORTS—FEBRUARY,
MARCH, APRIL, MAY AND JUNE, 1912.

By Dr. A. R. WARD, *Chief Veterinarian.*

Albay and Ambos Camarines.—Free from rinderpest.

Bataan.—One municipality has rinderpest infection as against four infected towns of February 1.

Batangas.—No rinderpest in this province since February 21.

Bohol.—On March 16 rinderpest was found in Sierra-Bullo-nes, but the province was declared free from the disease on June 24.

Bulacan.—On June 24 rinderpest was found in San Miguel.

Cagayan and Isabela.—Conditions remain the same as at last report. Only one town with known infection.

Cavite.—Free from rinderpest.

Cebu.—The quarantine which was placed on this province for rinderpest on December 29, 1911, was raised on June 10, 1912, by the Honorable, the Secretary of Public Instruction.

Iloilo and Capiz.—These provinces became infected for the first time in years during the month of May from a shipment of cattle and carabao imported from Indo-China. Before the Bureau could put a force of men in the field, the towns of Arevalo, Dumangas, Iloilo, Jaro, Oton, Passi, Pototan, and Santa Barbara, in Iloilo Province, and Capiz, Dao, Maayon, Panitan and Pontevedra, in Capiz Province, became infected. Both provinces have been placed under strict quarantine by the Honorable, the Secretary of Public Instruction. With the Scouts, Constabulary, and Bureau forces now in the field, it is hoped that a further spread of the disease will be prevented.

Laguna.—Rinderpest infection was discovered in this province on May 4, and at the present time the towns of Bay, Lum- ban, Magdalena and Pagsanjan are infected. This infection came from Indo-China cattle and carabao imported into the Philippines during the month of April. A strict quarantine

was placed on the province against rinderpest by the Honorable, the Secretary of Public Instruction on June 6.

La Union.—Free from rinderpest.

Leyte.—This province is free from rinderpest infection.

Mountain.—Lubugan is infected with rinderpest.

Nueva Ecija.—Free from rinderpest.

Oriental Negros.—Free from rinderpest.

Pampanga.—Seven towns are considered as infected with rinderpest, but the large force of Scouts and Bureau employees working in this district insure the speedy eradication of the disease from the province.

Pangasinan.—Binalonan and Binmaley are infected with rinderpest.

Rizal.—Four towns have recently become infected from a shipment of cattle and carabao imported from Indo-China. The province has been quarantined by the Honorable, the Secretary of Public Instruction. Conditions point to a speedy eradication of the disease.

Surigao.—Hinatuan is infected with rinderpest, but no new cases have been reported for some time.

Tarlac.—No known infection of rinderpest.

Tayabas.—No known rinderpest infection.

Zambales.—Botolan is infected with rinderpest.

General conditions.—At the beginning of the period covered by this report, fourteen provinces and twenty-nine municipalities were known to be infected with rinderpest. At the beginning of the month of May, this had been reduced to twelve provinces and twenty-four municipalities. Since that date new rinderpest infection was brought into Iloilo and Manila in a shipment of Indo-China cattle and carabao. While there still remain only twelve provinces infected with rinderpest, thirty-six municipalities are known to harbor the disease. All that has prevented a greater number of provinces and towns from becoming infected, has been the prompt measures which have been taken and the hearty coöperation on the part of the Scout forces and Constabulary, and provincial and municipal officials.

STATISTICS ON PRINCIPAL CROPS FOR FISCAL YEAR 1911.

[Compiled from the official reports submitted by the executive officers of 1 city, 716 municipalities, 80 townships, 22 rancherias, and 7 settlements.]

By BENJ. P. LUKENS, *Statistician*.

Crop.	Area cultivated.	Product.	Amount produced.	Approximate average value per unit in provincial markets.	Value of coconut products in provincial markets.	Approximate total value in provincial markets.
Rice	1,043,757	Cleaned rice	574,842,688 kilos	P0.1148		P65,391,940.58
Abaca	404,160	Abaca (Manila hemp)	171,879,598 kilos	0.16		27,500,735.68
		Ripe nuts used as food	154,980,726 nuts	0.09	P4,649,421.78	
		Copra	118,323,114 kilos	0.15	17,748,467.10	
		Coconut oil	6,602,966 liters	0.30	1,980,889.80	
		Tuba (a beverage)	37,649,880 liters	0.05	1,882,494.00	
		Total value of all coconut products				26,261,272.68
Sugar cane	120,313	Crude sugar and panochas	243,924,574 kilos	0.10		24,392,457.40
Corn	302,516	Shelled corn	186,404,700 liters	0.0468		8,723,739.96
Tobacco	69,015	Leaf tobacco	25,518,132 kilos	0.27		6,889,895.64
Total	2,148,237					159,760,041.94

Equivalents.—1 hectare equals 2.471 acres. 1 kilo equals 2.20462 avoirdupois pounds. 1 liter equals 0.908077 dry quart or 1.0567 liquid quarts. P1 (Philippine currency) equals \$0.50 (United States currency).

NOTE.—The total area of the Philippines including all islands both large and small was reported twelve years ago by the Manila Observatory to be 119,542 square miles, which is equivalent to 309,615 square kilometers or 30,961,500 hectares.

The amount under cultivation in the six principal crops appears then to be 6.94 per cent or approximately 7 per cent of the whole area of the Islands including mountains and arid lands. Stated in common fractions it would be about one-fifteenth of the whole area.

Since corn is largely planted on land devoted to other crops during part of each year, its area may be considered to partly offset the tracts of land which are known to be cultivated in bananas, camotes, magney, cacao, coffee, and other fruits and vegetables. Only two of these minor crops have been reported to this Bureau and tabulated, viz: Magney, 13,346 hectares, and coffee, 1,948 hectares.

Persons desiring detailed statistics regarding crops may obtain the same by sending a written request to the Director of Agriculture, Manila, P. I. A statistical bulletin showing the production of the principal crops by provinces is now being printed and may be had upon application.

PRINCIPAL PHILIPPINE IMPORTS AND EXPORTS—MAY.

By the INSULAR COLLECTOR OF CUSTOMS.

[Values in dollars United States currency.]

IMPORTS.

Articles.	Manila.	Cebu.	Iloilo.	Total.	
Rice	{ Kilos	19,326,313	2,431,335	2,078,916	23,836,564
	{ Value	790,783	97,708	95,406	983,897
Beef cattle	{ Number	3,228			3,228
	{ Value	66,028			66,028
Sugar	{ Kilos	296,259	41,595	14,742	352,596
	{ Value	21,357	3,388	1,175	25,920
Coffee	{ Kilos	40,796		541	41,337
	{ Value	14,389		183	14,572
Cacao	{ Kilos	58,864	10,131	2,068	71,063
	{ Value	19,298	2,920	634	22,852
Eggs	{ Dozen	524,495	199	303	524,997
	{ Value	36,350	16	40	36,406
Raw cotton	{ Kilos	55,247			55,247
	{ Value	14,066			14,066

EXPORTS.

Hemp	{ Kilos	7,814,042	1,924,943		9,738,985
	{ Value	944,560	221,559		1,166,119
Sugar	{ Kilos	7,608,504	186,583	4,004,244	11,799,331
	{ Value	409,200	9,075	204,792	623,067
Copra	{ Kilos	12,118,830	2,787,923		14,906,753
	{ Value	1,173,861	275,700		1,449,561
Cigars	{ Number	16,346,036			16,346,036
	{ Value	273,998			273,998
Cigarettes	{ Number	3,306,175			3,306,175
	{ Value	2,987			2,987
Tobacco	{ Kilos	889,617			889,617
	{ Value	149,632			149,632

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

By the DIRECTOR OF THE WEATHER BUREAU.

MAY, 1912.

[Temperature and total rainfall for twenty-four hours beginning at 6 a. m. each day.]

Date.	Hemp.				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.		Temper- ature.	Rain- fall.	Temper- ature.	Rain- fall.	Aparri.		San Fernando.	
	Temper- ature.	Rain- fall.	Temper- ature.	Rain- fall.					Temper- ature.	Rain- fall.	Temper- ature.	Rain- fall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1.	28.6		27.8		28.8		30.7		27.5		30.2	
2.	29	1.5	27.9		29		30.5		27.6		30.5	
3.	29		28	1.3	29.4		30.6		28.4	1.8	31.1	
4.	28.9		27.6		28.7		30.8		28.2		30	
5.	28.5		27.8		28.5		30		27.4	.8	30.8	
6.	28.1		28.2		27.4		30.8		27.4	4.1	28.9	
7.	28.5		28.3		28.4		29.9		27.9		28.6	
8.	28.5		28.1		28		28.6	17.8	27.2	1	28.8	
9.	29.2	.8	27.8		28.6		30	2	27.1		28.6	
10.	28.9	2	27.1	.8	29.3		29.3		27.4		30.9	
11.	28	3	28.1		29.7		29.8		28.3		30.8	
12.	29.5		28.2		29.5		30.8		28.3		30	
13.	29		28.5		29.1		30.2		28.2		30.1	
14.	29.6		29		28.7		29.5		28.8		30.5	
15.	30		29.2		29.1		29.3		28.6		30.4	
16.	29.7		29		29.2		29.8		28.8		31	
17.	29.9		29	2.5	28.3	2.5	30.2		28.4		30.4	
18.	30.2	.8	28.7		29		30	17.5	28.5		29.9	
19.	30.3		28.7		30.4		30.4		28.6		29.9	
20.	29.2	1.3	28.4	.3	30.2		30.9		28.2		29.7	1
21.	29.2		28.6		27.9	8.1	29.2	45.7	28.2		29.4	
22.	28.8		28.4	.5	27.8		29.6		28.1		29.5	
23.	29.5		29		28.4		29.8		28.2		29.2	
24.	29.2		28.9		29.2		29.2		28.3		29.2	
25.	29.1		28.8		28.2	.3	29.6	4.6	28.2		30.1	.8
26.	29.7		28.9		28.3		30		29.1		29.6	
27.	29.3	22.6	29.1	10.2	28.6	1.3	29.3	3.8	28.6	.5	29.9	
28.	29.2		28.9		28.4		30.2		27		31.2	3
29.	29.8		29.4		29.5		30.2		27.6	8.4	31.4	
30.	29.8		29.4	1.5	28.8		30	10.2	27.7	19.3	30.8	
31.	29.2		29.6		27.5		30	12.7	26.6	10.7	30.9	

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