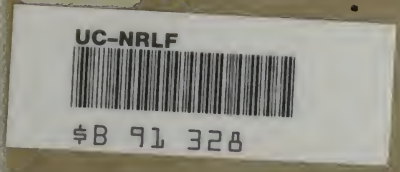

ECONOMIC RESOURCES AND DEVELOPMENT OF THE PHILIPPINE ISLANDS

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SOURCES OF INFORMATION ON PHILIPPINE COMMERCIAL AND INDUSTRIAL DEVELOPMENT.

Detail information on resources, commercial and industrial development is available at the following American and Philippine Government Bureaus:

Bureau of Insular Affairs, U. S. War Department, Washington, D. C.

Far Eastern Division, Bureau of Foreign and Domestic Commerce, Washington, D. C.

Bureau of Commerce and Industry, Manila, P. I.

Bureau of Science, Manila, P. I.

Bureau of Agriculture, Manila, P. I.

Bureau of Forestry, Manila, P. I.

Philippine Commercial Agency, Grand Central Palace, New York City.

Philippine Commercial Agency, Merchants Exchange Building, San Francisco, California.

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PREFACE.

This is the first issue of a series of bulletins which the Philippine Commercial Agencies will publish from time to time. Its aim is to furnish those who are interested in the economic development of the Philippines with reliable data on the commercial and industrial development of the country.

It is arranged in the form of a compilation of articles, prepared by those who have first-hand information on their topics, for the purpose of giving the information something of a personal touch.

Acknowledgments are due the New York Office of the *Trans-Pacific Magazine, The Manila Daily Bulletin,* The Manila Merchants Association, *Lumber* and the *American Exporter* for their co-operation in permitting reprint of special articles originally appearing in their publications.

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PHILIPPINE COMMERCIAL AGENCIES IN THE UNITED STATES.

By Arsenio N. Luz,

Philippine Government Commercial Agent, New York.

The desire of the Government of the Philippine Islands to establish closer commercial relations between the Philippines and the United States has been crystallized into action. During his recent visit to America in 1919 J. J. Rafferty, Director Philippine Bureau of Commerce and Industry, established two commercial agencies as

local offices of the Philippine Bureau of Commerce and Industry, one on the Western and the other on the Eastern Coast, San Francisco and New York. Similar agencies will soon be opened at other important points in the United States.

The activities of the Philippine Commercial Agencies are varied. But their primary object is to establish closer trade relations between the Philippines and the United States.

These offices are prepared to advise those contemplating investment or desiring information about the natural resources of the Philippines, particularly in regard to the development of hemp, cocoanut, sugar, tobacco, coffee, rubber, and pineapple plantations, the mineral and timber resources, and to furnish the latest official commercial statistics.

They are in close touch with leading American Chambers of Commerce and exert every effort to give the American business man service and advice regarding future investment in the Philippine Islands. Twice a month information bulletins are issued. They give a résumé of up-to-date commercial statistics, recent legislation affecting commerce and trade, and an accurate description of the progress and development of the business of the country.

Information regarding shipping, packing instructions, custom and tariff laws, banking facilities and all other details needed by the exporter or the manufacturer will be promptly and accurately given upon application.

To a prospective American exporter our help will consist in aiding him in his study of the market. We shall tell him whether a demand exists or can be created for his goods of the quality and price offered by him. We shall inform him of the personnel of the trade channels and the commercial practice in the Philippines. We shall advise him of the factors which determine for each exporter the trade channels best adapted to his circumstances to secure trade contact with our market. In fine, we shall tell him whether his goods can be exported to the Philippine Islands and sold at a profit.

To an American prospective importer of Philippine goods, we are ready to give the proper connections and aid him in the acquisition of Philippine products under the best of terms. We have in our files complete lists of Philippine dealers in all staple products and other principal exports of the Filipinos. These lists are at the disposal of those who desire to establish trade connection with any Philippine business man.

At the Grand Central Palace, New York City, and at the Merchants Exchange Building in San Francisco, California, those interested in a display of beautiful hand-made Philippine embroideries, hats and agricultural products of the Islands, have at their disposal the permanent exhibits of the Commercial Agencies.

Our motto is "Service." American business men are invited to avail themselves of the help these offices are ready to give them for the fostering of closer trade relations between the two countries and the development of Filipino-American trade.

RURAL CREDIT ASSOCIATIONS IN THE PHILIPPINES.

By A. W. Prautch,

Chief, Philippine Rural Credit Division, Bureau of Agriculture.

The Rural Credit Law of the Philippines was enacted to remove the restriction in the Corporation Law requiring 200,000 pesos paid-in capital before a bank may be started, and to provide rules and regulations to insure the operation of the rural credit associations and safeguard the interests of small investors, general public and Government. These associations may incorporate with a paid-in capital as low as 100 pesos or as high as 10,000. The shareholders who contribute this sum elect boards of five directors, who approve or disapprove loans, sell shares, borrow working capital and manage all the affairs of their associations. Where the directors are active the work goes forward, but where figurehead directors are selected, because of social standing or prominence, the association lags, yet this very experience teaches the lesson of self-government more effectively than theory ever could, and there is always the opportunity at the next election to remedy the unfavorable condition by changing the membership of the board.

The law specifies that only one association may be incorporated in a municipality, the purpose being to avoid rivalry and factions. The provision that the bonded municipal treasurer shall act as treasurer ex-officio without extra remuneration and that the Government auditor shall audit the association's books at the same time municipal accounts are being audited inspires the unsophisticated investors with confidence in the association. Thus they are satisfied that their few pesos are safe. Possibly no other single feature has contributed more to the success of the associations than this wise provision for the protection of the funds.

All payments are made by the treasurers on vouchers passed by the board of directors. No individual may own more than 500 pesos' worth of shares, and each shareholder has only one vote, irrespective of the number of shares he owns. Associations enjoy certain exemptions until their paid-in capital stock is 10,000 pesos. Among these are the following: Taxes, revenue charges, revenue stamps, registration fees of mortgages or documents, court fees incidental to the collection of unpaid debts and the like. These exemptions are allowed to continue until the association is on its feet and can pay its way.

The Government furnishes no financial help directly or indirectly after the associations are formed. The organizing staff is paid by the Government, as otherwise no one would systematically and continuously push this solution of the question as to how to provide working capital for small farmers by banding them together into a "home defense guard." No one in the association receives pay; their public spirit and civic pride are appealed to. Forms, supplies, books and share stock forms are paid for by the association out of a fund made up from the small entrance fees. Everything aims to develop self-help. The agents never do for an association what it can do for itself, nor do they omit to point out the danger of a doubtful course and the advantages of right management. Naturally, anything contrary to the Rural Credit Law (No. 2508) is sternly stopped, and the reason is clearly stated. The character of rural credit associations must, like Caesar's wife, remain above suspicion, a condition which would not continue without a Government staff to advise and guide in the apprentice period.

In getting the work started the organizing staff of the Bureau of Agriculture's Rural Credit Division visits towns, distributes copies of Law 2508, points out the benefits which the whole community will reap if the small farmer can keep the money which he would otherwise expend for usurious interest on the loans he must have. It is also pointed out that this interest stays in the town instead of going to the capitalists in the large centers, and that in time a strong village bank will be the result of this co-operative effort. People who are not borrowers are urged to buy shares in order that a worthy institution may have funds to lend. If sufficient interest is manifested they proceed to organize. A meeting is called and those who have subscribed and paid for shares select the incorporators, of whom there cannot be less than five nor more than fifteen. From these, five directors are chosen to serve until the first shareholders' meeting is held, when these or other directors are formally elected. Incorporation papers are registered without expense to the association. The directors then receive applications for loans and approve or disapprove them. Their action is final.

If an application is approved a voucher is drawn on the treasurer, and the money is paid to the borrower. The law compels the exaction of security for all loans, which security may be represented by mortgage on land, pledge of work animals or the like, or by endorsement by "two persons of recognized solvency in the community." Our work is done only on personal guaranty because the loans are small, and if the borrower is doubtful or tricky his application is disapproved by the directors. The division has even begun a step further back by refusing admission to membership of such characters, thus

reducing the number of refusals. These associations do not attempt to reform loafers or to provide easy money for the careless, but aim to unite earnest, industrious farmers in a co-operative self-help association.

When the paid-in capital is 1,000 pesos or more an association is permitted by the Philippine National Bank to borrow an equal amount on the security of its capital and the joint and several notes of the five directors, whose assessed property is certified to by the municipal treasurer. The National Bank also lends larger amounts to associations on the joint and several security of growing crops, stored produce, work animals, sugar mills and other property of the members, the mortgage being made out in favor of the association, which is a corporation, and this accompanies the joint and several note of the directors. There is no maudlin sentiment or mistaken pity for the poor, but practical help for those willing to help themselves. The bank charges 8 per cent. to the association, which charges its members 10 per cent., the resulting profit going to the association. Twenty associations have received loans aggregating 80,000 pesos.

The first rural credit association was incorporated October 19, 1916. There were, on May 20, 1919, 325 incorporated associations and over 100 more in various stages of organization. The paid-in capital at incorporation was 164,846 pesos, which has been increased by further sales of shares to more than 400,000 pesos. Over 30,000 members have bought these shares, and loans aggregating over 350,000 pesos have been made to over 6,000 members. Official returns from the treasurers were made December 31, 1918, and this estimate, which is probably conservative, is made on reports of progress sent in by the division's agents.

In addition to these financial activities, the Legislature designated the rural credit associations to be agents to lend 1,000,000 pesos to responsible persons who will plant uncultivated areas in rice and corn. The Secretary of Agriculture and Natural Resources finally passes on such applications received from associations. No loans may be made directly to individuals, the reason being that no central agency can possibly determine the reliability of the applicant as well as can the directors of this association. The expense and trouble of investigation is obviated by making the total loan to the association under precisely the same conditions as the National Bank loans are made, as explained above. The directors having assumed responsibility for the repayment of the loan, will, for their own personal protection, exercise great caution in lending this money only for productive purposes and to responsible persons. The purpose of the 1,000,000 pesos fund is to develop the production of food in the Philippines to the point where importation of rice will be unnecessary. By May, 1919,

applications had been received from 170 associations, totaling over 800,000 pesos. These were being carefully investigated, and Secretary Apacible had already granted loans amounting to 212,600 pesos to 53 of these. It would have been very difficult, if not impossible, to have carried out these useful loans without the co-operation of the rural credit associations, with their local knowledge and community interest.

No one cares to read about failures. In justice to the 325 associations it should be said that there is not one which can be styled a failure. Two hundred are making healthy progress, the others have ailments which, while not fatal, retard their growth. Their chief trouble is that they have been unfortunate in the selection of directors. But the money they manage is their own, and they are working out their own salvation. The Division hopes they will outgrow their infantile troubles and is encouraged by signs of improvement. In three cases the interests of the men on the boards suffered by the liberation of the poor. Naturally they opposed progress, but even in associations thus handicapped a large number of members clearly see the light, and time and another election will remedy the temporary setback. There are also some "one-man" associations, the machinery of which stops when this one man is absent. It is not possible to realize the ideal type of association without depriving the members of initiative and liberty, and doing everything for them. If these are to be worth-while associations, they must be co-operative, and even if it takes years to put the backward ones on their feet the time will be considered well spent.

San Remigio, Antique Province, is a small, poor town. Its association asked to be incorporated on July 14, 1917, with only 94 pesos cash in hand. In consideration of its condition, this was granted. Six months later the writer visited this humble community and found that its association had over 1,000 pesos capital, and that all but 4 pesos was lent out. At a meeting of all the members I heard statements of loans as small as 7 pesos being granted to the needy. I got a loan of 1,000 pesos for this valiant association from the National Bank, which doubled its working capital. The members labored on with new hope, and in March, 1919, they had completed 5,000 pesos of their own paid-in capital. This, with the money borrowed and deposited, gives them a working capital of nearly 10,000 pesos. One example of self-development like this convinces me that the plan is adaptable to the people and that the people will adapt themselves to the plan.

In Sibalom, Antique Province, at a meeting of the directors and a dozen leading members, several speakers reviewed the happenings of the 18 months' existence of this association and stated that the 6,000 pesos of their own and borrowed capital had given their members a direct benefit of over 30,000 pesos. Formerly they had been com-

pelled to repay each peso borrowed at planting with a cavan (44 kilos) of unhusked rice. This year the directors had supplied really necessary money and had advised applicants how to do without unnecessary expenses; they had also advanced money needed after harvest to enable the grower to hold his rice until the market improved and he could benefit by the rise in price.

It is impossible in this article even to mention several hundred similarly encouraging incidents in various associations. It suffices to say that the plan of making the "scholar" work out his own problem, instead of putting down the correct answers on his slate without his knowing why or how the "answer" was reached, is bringing the desired results.

It would be interesting to write of the dozen women farmers who are incorporators and directors; of the score or more Roman Catholic priests, incorporators and directors, who are helping their flocks to enjoy something of heaven this side of the pearly gates; of the hundreds of disinterested teachers, officials and citizens who are doing their bit to improve associations and communities.

Our greatest problem lies in the imparting of an understanding of the principles of rural credit to the large majority of members who know absolutely nothing about co-operation beyond the point that the plan, as presented to them, seemed good and they bought shares. Unless the principles of co-operation are constantly insisted on, these associations will degenerate into village money-lending concerns instead of being moral and social regenerating centers. Their possibilities for good are great. It is also apparent that if they are not carefully supervised, and if promptness in payments is not exacted, their possibility for evil will be equally great.

No defalcation or serious differences between directors have occurred. Earnest efforts by agents and well wishers have kept the work at a high standard and there we shall ever endeavor to keep it, working at the same time to increase the number of associations and their efficiency among a people who have suffered much through usury and who welcome any plan that offers relief.

PHILIPPINE RAILWAYS AND THEIR RIVALS.

By A. E. Gilmount.

Compared with the phenomenal progress made along agricultural and industrial lines, railroad communications in the Philippines have not reached such a stage of development as could be expected; yet the country is about as well served with railways as conditions justify. While there may be room for extensions and new lines the fact, borne out by figures, is that to-day the Islands have more mileage than can

be properly supported by revenues, a condition due in no small measure to keen competition from motor and water transportation. About 755 miles of railroad are being operated, the major part by the Government, and the remainder by a private concern. The Government lines are located on the Island of Luzon, while the private roads are confined to the Islands of Cebu and Panay. About 30 miles of track are now under construction, and about 100 seriously projected, so that several years will probably pass before Philippine railroads reach a total length expressable in four figures; and this is after 32 years of railroad enterprise in a land of 120,000 square miles, with 10,000,000 people, and with business and industrial investments estimated at half a billion pesos.

The public and the railroads have, so to speak, been journeying hand in hand, a sort of struggle between cost of operation and traffic revenues. Within the last three years, however, since Government ownership was initiated, the people have been gradually educated to the value of railroads and what they mean to the development of the country, and, incidentally, to the negotiable values of real estate. The latter feature has perhaps proved the most convincing argument.

Considering the physical features of the Philippine Archipelago with the fact that every point on the coast is well served with coastwise steamers operating on regular schedules, one can readily understand why railroads in the Islands will never equal in mileage or investment those of many other insular countries, to say nothing of the big continental systems. Water transportation has always been, and probably always will be, the principal means of carrying passengers and cargo. In consequence there is to-day an inter-island fleet, including a number of speedy and well-appointed steamers, the tonnage of which is very creditable.

Another formidable rival to the railroads, which already has taken hundreds of thousands of pesos from their earnings, is motor transportation. Following the completion of numerous highways initiated by the Forbes administration, well organized systems of motor transportation have been established throughout the Islands, and these by cheap rates have reduced railroad travel to almost nothing in some places.

Of the 755 miles of road in the Islands, four-fifths are on Luzon. A hasty glance at the map would lead one to believe that at least half a dozen of the Islands should be able to support railroads, but this is not the case, according to railroad experts who, following the American occupation, made a complete survey of the field. All the Islands are skirted by narrow coastal plains which gird mountains or hilly country, where railroad construction and maintenance would, considering the earnings, be a ruinous undertaking.

The Manila Railroad Company, a British corporation operating in Luzon until 1916, was on the verge of failure when the Government took it over. The Philippine Railway Company, operating in its fourteenth year in the Visayas, is expected to pass into Government ownership soon. Its lines on the Island of Cebu are hopeless, experts say, unless modified for suburban service around the City of Cebu, while the Panay line is only a tolerable business proposition.

In Luzon, the Government is now engaged in extending its Manila-South line to the southern point of the Island. This program will occupy several years. The only other considerable project which the present directors consider is an extension from Central Luzon up through the heart of the Island to the big river valley which drains the northeast provinces. This is looked upon as the limit for Luzon for decades.

The Island of Mindanao in the south will some day support considerable railway lines, but present belief is that such will not be provided within the next 20 years. The country is practically untouched, so that, while railroads would hasten tremendously the development of great resources, the investment would most likely be tied up for a considerable period.

Such in general are the conditions, which have, up to 1919, after 32 years of railroad development, attracted an investment of close to $45,000,000.

The present absorbing feature of Philippine railways is the matter of Government ownership. The war hastened the downfall of the Manila Railroad Company, which during 1914, 1915 and 1916 began to show losses; but other elements of degeneration, such as the loss of $2,500,000 in a projected branch from the main line up through the terrific mountain country to Baguio were already spelling disaster for the railroad, and preventing it from furnishing Luzon with adequate rail service.

The Manila Railroad Company franchise was granted by the Spanish Crown in 1886, and work was commenced the following year. In 1889, Horace L. Higgins took over the management of the construction and road, continuing in charge until January of 1917, when the road passed over to the Government. After five and a half years, late in 1892, 120 miles of track between Manila and Dagupan were in operation, the cost having been approximately $4,000,000. The interesting history of the road during that period and until the end of Spanish rule is all but lost, for the English owners left few of the documents which passed between them and the Spanish authorities.

From 1898 to 1901 insurrection in Luzon wrecked large portions of the track and property. For a period the United States Quartermaster Department operated the railroad as fast as it was taken from the

insurgents by United States forces. Subsequently, the United States Government paid the company indemnity for the damages sustained through granting additional franchises and Government guarantees.

An extensive construction program was financed from 1906 to 1913, lines being extended both north and south. With the advent of the European war and other adverse conditions, however, the company found itself financially embarrassed and the Government took over outstanding stock with a par value of $5,783,500 for a price of $4,000,000, as well as obligations amounting to about $31,000,000.

In 1916 the Philippine Government was severely criticized for its purchase of the Manila Railroad. However, in face of the financial results obtained by its administration, placing the road on its feet financially, all opposition to Government ownership has ceased. Another important factor favoring public ownership is lack of private capital. While private capital may be secured for industrial enterprises, none is forthcoming for public utilities subject to Government supervision.

Government ownership has proved successful, and now the insular authorities are negotiating for the purchase of the lines on Cebu and Panay, belonging to the Philippine Railway Company.

AGRICULTURAL RESOURCES AND THEIR DEVELOPMENT.

PHILIPPINE TOBACCO.

By Domingo B. Paguirigan.
Bureau of Internal Revenue, Manila, P. I.

Tobacco was introduced into the Philippines by Spanish missionaries coming from Mexico during the last quarter of the sixteenth century, shortly after the establishment of Spanish sovereignty. The production of tobacco, however, did not become a real industry until 1781, when the Spanish Government enforced its exclusive rights to traffic in the product and when the production and sale of the commodity were formally made a state monopoly. This monopoly lasted throughout the hundred years from 1783 to 1883. Under government control every detail of the industry, from the preparation of the seed beds to the marketing of the leaf or its products, was strictly supervised by qualified officials. In the field, there was a chief appraiser, styled "*interventor,*" residing at the provincial capital, who had forces of subordinates known as "*alumnos aforadores.*" These officials were further administratively aided by the municipal "*caudillo*" (head man), who was also the "*gobernadorcillo*" (little governor), and by his "*tenientes*" (lieutenants, or overseers). Penalties were inflicted

upon growers who failed to observe the instructions or orders issued by the Government.

The crop produced by a grower was limited by the Government according to the size of his family and cured only in especially built drying sheds. The product therefore gained an enviable reputation for quality. But hard and strict as the measures regulating the growing and curing of tobacco were at that time, the natives, soldier-like, soon became accustomed to the discipline. As a proof of this fact, later on, when it was rumored that the system was to be abolished, most of the native growers energetically opposed its discontinuance to such an extent that even the friars advocated their cause. Only the scandalous abuses and the graft which generally prevailed among the subordinate officials finally led to the absolute abolishment of the system.

During the existence of the tobacco monopoly, it was the chief source of income to the Government, and even in its irregular last year it yielded enough to cover about 50 per cent. of the total budget of expenditures.

Contrary to expectation, once the force which had compelled the growers to follow fixed regulations was withdrawn, the methods of production gradually went from bad to worse. The planters ignored quality for quantity, and the general results were that good practices were more or less neglected. However, the planters should not be too much blamed, for the prevailing method of buying tobacco even to-day is based chiefly on weight, the standard being the Spanish quintal, which is equivalent to 46 kilos, or about 102 pounds. Competition is so keen among the buyers that they do not take the proper time to examine the quality of the crop, but simply offer a price for each lot as a whole.

In 1909, when the United States Congress passed the Payne Bill, which includes a provision admitting Philippine tobacco into the United States free of duty, contrary to the belief that such a privilege would help restore the value of our tobacco, matters went unfavorably. The causes of failure of Philippine tobacco in the United States proved to be matters and incidents which a timely pre-acquaintance with American business ways could have easily prevented. The farmers were allowed to grow their tobacco as they pleased. Leaves from the provinces came to the factories in Manila in awful mixtures, and on account of rush orders from America the leaves were used without being thoroughly sorted. One of the inevitable results following such practices was that the identity of the cigar brands became lost. A brand cannot be identified unless it is made of the same color and grade of leaf or leaves, so that the flavor will be uniform and peculiarly distinguishable from that of other makes.

On account of the extremely big orders, which Manila manufacturers were not used to, the same error committed by the growers in producing for quantity instead of for quality also prevailed in the cigar factories. Barely trained apprentice cigar makers were employed in the manufacture of export cigars. The factories were kept working even nights. Colors cannot be easily distinguished in their true shades by artificial light. Philippine manufacturers did not realize that they were dealing with shrewd American business men. Neither did they realize that the production and manufacture of tobacco is also one of the greatest American industries. No attempt was made to distribute Philippine cigars uniformly throughout the United States, though it is really no air castle to suppose that out of every 1,000 American smokers it is possible to find at least 20 who either already like the mild aroma of Philippine tobacco or who would learn to like it had they but a chance to get the cigars. Our manufacturers just turned their cigars loose. They did not stop to think that many of those who formed the vanguard of American importers were not as friendly to the incoming of Philippine tobacco as they seemed. Manila cigars were sold at a nickel, in many cases even at a loss, in an effort to make the American smoking public believe that Manila cigars are of cheap stuff. Smaller importers of good faith, not being able to stand against cut prices of the bigger importers, had to cease handling Manila cigars. Another peculiar fact that contributed to the failure of Manila cigars immediately following the passing of the Payne Tariff Law was the inability of Manila manufacturers to supply the American public with large stocks. These circumstances resulted in substitution on the part of some American jobbers, cheap and low-grade American cigars being labeled as " best Manilas " after the stock of Manilas became exhausted.

The Insular Government, seeing the deplorable condition of the trade after six years of such competition, enacted a law in February, 1916, " to improve the methods of production and the quality of tobacco in the Philippines and to develop the export trade therein." This law proved to be of inestimable value to the development of the Philippine tobacco trade, by establishing a system of inspection for leaf and manufactured tobacco and at the same time carrying on an advertising campaign intended to bring home to the American importer the good quality of Philippine tobacco.

For the purpose of furthering the advertising campaign, it was found practicable to entrust this work to Mr. C. A. Bond, who is well known to the tobacco trade and who has had experience in the Philippines, having been at one time a newspaper man in Manila. Since the passage of that act, the trade has progressed apace, the exportation to the United States rising gradually from 114,006,745 cigars in 1916 to 216,124,310 in 1917, and 264,871,253 in 1918. This increase is a happy

omen that the Manila cigar is gaining popularity in the United States market.

Prior to 1916 the amount of Philippine leaf tobacco exported to the United States was negligible, but during 1916 this export item increased to almost twelve times the amount of 1915 and more than twenty times that of 1914. In 1918 leaf exportations to the United States reached 2,957,264 kilos, an amount representing a decrease in comparison with 3,283,264 kilos exported during the previous year. The greater number of cigars exported and the limited quantity of the 1916 and 1917 crops were responsible for this condition.

The actual exportation of Philippine leaf tobacco to the United States has been as follows during recent years:

	Kilos.
1914	20,683
1915	39,637
1916	633,771
1917	3,283,607
1918	2,957,264

The European War contributed to the increased demand for Manila cigars on account of the large supplies of tobacco products sent to Europe and because of the fact that a large number of hands formerly engaged in the tobacco factories in the United States had to be diverted to war activities. The cigar that has appealed most to the American smoking public is the 5-cent Manila.

During 1918 several complaints were received that musty cigars were arriving in the United States, and in most cases the blame has been placed on both the manufacturer and the Government. Act 2613, although guaranteeing the tobacco products exported to the United States, sets limitation on this guarantee. These complaints, however, need investigation, considering the fact that the average price per thousand paid for Manila cigars in 1918 was 43.68 pesos, as compared with 38.25 pesos paid in 1917.

Through the Bureau of Agriculture the Government is determined to procure greater production and higher quality of tobacco. Curing under proper methods is required by law. A five-year testing project has been undertaken in Isabela Province, with the following aims in view:

1. Isolation by selection of the highest grade strains from local varieties.
2. To obtain, by constant testing, strains of the highest hereditary value.
3. Distribution of selected seed.
4. Production of standard wrapper tobacco by:
    a. Seed selection.
    b. Cultural methods.
    c. Hybridization.
    d. Acclimatization of foreign wrapper tobacco.

5. Constant testing of wrapper strains.
6. Study and control of tobacco pests.
7. Curing experiments.
8. Miscellaneous experiments.
9. Extension work with the co-operation of the tobacco inspectors on behalf of wrapper tobacco production.

While the work at the Tobacco Experiment Station is progressing, the farmers are being instructed, and expert seed selection and other approved cultural methods are being demonstrated to them by specially qualified Government tobacco inspectors. As the results of investigations and the propaganda campaign being undertaken by the Bureau of Agriculture, Nueva Vizcaya, a province heretofore growing hardly any tobacco, was found to possess soils and a climate similar to those of Isabela, and consequently was induced to grow tobacco on a large scale, so that now it is one of only three provinces in the islands that produces the tobacco from which standard brands of cigars are exclusively made. It is expected that other regions suitable for the growing of superior tobacco will be located. Although tobacco is grown practically in every region of the Philippines, the Government is determined to limit the manufacture of standard cigars from leaves produced only in regions peculiarly suited for the production of cigar tobacco. The Cagayan Valley is the Vuelta Abajo of the Philippines. Evidence of the justice of this claim lies in the fact that by many the present product is considered so good as to be unsurpassed in spite of prevailing haphazard methods.

The standard Manila smoke guaranteed by the Government is noted for its mild, free-burning and aromatic quality. The naturally agreeable flavor of Philippine tobacco makes the employment of chemists in the Manila tobacco factories unnecessary. In America thousands and thousands of smokers now believe that "Manila cigars are selling on their merits, and not on their prices." The Philippine Government affixes to each box of Manila cigars sent to the United States an official inspection label certifying that the cigars are made by the Spanish hand process, packed under modern sanitary conditions, under the supervision of competent Government officials, and that upon arrival in the United States every box of "Manilas" is in proper condition.

There are splendid opportunities for the investment of capital in tobacco growing in the Philippine Islands. The Cagayan Valley, which is the region where the finest tobacco is grown, is unequaled for its natural advantages. This valley lies between two mountain ranges situated in the northern part of the Island of Luzon and contains a tobacco belt about 150 miles long and varying width up to 10 miles.

The valley is inundated annually to a depth of from 5 to 40 feet, and there is a consequent annual deposit of silt amounting to several inches in thickness. Under these conditions, artificial fertilizers are unnecessary and so unknown in this district. Many thousands of acres of choice tobacco land are lying idle and unoccupied on the banks of this "Nile of the Philippines." These lands are a part of the public domain and are open to occupancy under the homestead law or by purchase. By purchase the price would be about $2 per acre, and this nominal price may be paid in installments, a total period of five years being allowed. Corporations are limited to 2,500 acres of this land. Outside of some ten or twelve large plantations, practically the entire tobacco crop in the Cagayan Valley is grown by the 28,000 small planters having holdings of three or four acres.

Labor in the valley is scarce, but the Government is ready to aid through its established agencies in securing laborers from the thickly-populated districts on a contract basis. If the owner of a large plantation will have proper regard for the social and hygienic welfare of his laborers and treat them with fairness in their business relations, in a short time a loyal and intelligent force can be trained in the proper methods of cultivation. Experiments with such methods have shown an increased yield of such superior quality that it is certain that if some of the attention and care which is bestowed upon leaf tobacco in other countries were bestowed upon Philippine leaf, the Cagayan Valley could produce cigar filler the equal of Havana in popular estimation, and wrapper leaf the equal of the famous Sumatra. To-day there is hardly sufficient leaf of the needed quality for the local markets. In 1916 the 10,000,000 Filipinos who inhabit the Archipelago smoked some 80,500,000 tax-paid cigars and 4,135,000,000 cigarettes. Every year since 1904, when the Internal Revenue Law took effect, the consumption has greatly increased. Not only is there the ever-growing domestic market to be considered; there is the European market, which in the past has been a steady purchaser of large quantities of leaf, and in spite of the war has absorbed a quantity only slightly less than in years before. Now that peace has come, a substantial increase in the European demand is to be reasonably expected.

The annual acreage and production of tobacco are given below from figures prepared by the Division of Farm Statistics of the Bureau of Agriculture:

	Acres.	Pounds.
1912	140,948	65,219,646
1913	170,477	101,545,657
1914	150,549	102,809,218
1915	131,809	84,264,780
1916	144,574	90,506,183
1917	152,549	107,642,966
1918	193,832	135,421,708

COCONUT GROWING AND COPRA.

By M. J. DE LA RAMA,

Manager, Philippine Commercial Agency, San Francisco, California.

The coconut tree is a palm of the species "*cocos nucifera.*" It thrives in almost all tropical lands, chiefly the Philippine Islands, Dutch East Indies, Straits Settlements, Ceylon and South Sea Islands.

There are approximately 70,000,000 coconut trees in the Philippine Islands, about 40,000,000 of which are bearing trees, producing nearly 1,000,000,000 nuts per annum. Approximately 900,000,000 of these nuts are made into copra.

The total acreage devoted to coconuts is about 750,000. This area is only a slight fraction of the total land adapted to coconut growing.

Of the total area of 120,000 square miles of the Philippine Archipelago, only 14,000 square miles are to-day planted to crops or otherwise cultivated. This vast extension of uncultivated land will give an idea of the tremendous opportunities for the establishment of coconut plantations, which can be started almost anywhere in these rich tropical islands.

Excellent land under the public domain and specially adapted to coconut growing can be leased or purchased from the Government at nominal prices. The clearing and planting of the land does not require a great amount of initial capital.

No other crop produced by man is reaped with more certainty and marketed with less labor and expense after the initial cost has been incurred. Because of the permanency of the trees when planted in a region free from typhoons a coconut in bearing constitutes a crop virtually as constant and undying as the earth on which it stands.

The tree gets into bearing after five or six years after planting, and constantly thereafter for practically "all time to come."

The trees give best results when planted about 125 to the hectare, or 50 to the acre. They may be relied on with reasonable assurance to produce in the fifth year ten nuts each, worth, at a conservative estimate, about 2 cents per nut, or a return of about $10 per acre. The sixth year the trees should produce about 40 nuts each; the seventh year about 60 nuts each; the eighth year about 80 nuts each; and the ninth year about 100 nuts each. The trees reach their most productive period at about twenty years after planting, and this period lasts until about the fortieth year. During this period from 125 to 150 nuts may be expected from each tree as an average production. Many trees under favorable conditions produce, during this period, 200 to 300 nuts per year. The record yield is said to be 470 nuts from one tree in a year. There is said to be but slight diminution in the yield of a mature tree until it is almost a hundred years old.

The planter is not compelled to wait for returns on his investments until his coconut trees begin to produce, as he can raise corn, beans, peanuts or hemp on the same land on which his young coconut plants are growing.

The coconut is a plant of many uses. The trunk is sometimes used as pillars or posts of Philippine houses. The ribs of the leaves are used for making brooms. The fibrous outside shell of the nut or coir is chiefly used for household fuel and sometimes in the manufacture of rope, mats, ship caulking materials, etc. The hard shell of the nut was found to be valuable during the war as a source of a chemical substance which was used in making gas masks. These shells are often used to make drinking cups and similar utensils. The sap of the bud is a good source of alcohol.

Copra.

Copra is the dried meat of the coconut and is prepared for the purpose of producing coconut oil.

To prepare copra, the coconut is split and the meat partially dried while in the shell; the meat is then removed and the drying completed. Drying is done either by the sun or artificially.

Classes and Output of Copra.

There are three classes of copra. "Sun-dried," as its name indicates, has been thoroughly dried in the sun. This is the best grade. "Fair merchantable Manila" is copra which was partially or imperfectly dried when received in Manila and which has been re-dried. Low-grade copra is that which is smoked and scorched and is rancid.

The modern method of drying copra is by means of the copra dryers, which do not expose it to dampness or smoke.

The Philippines produce one-third of the world's output of copra. Up to the year 1918 almost all of the copra produced was exported. In 1919 the quantity of copra exported was only half of that of 1918. In 1919 the Islands exported $4,400,000 worth of copra, but imported $3,200,000 value from other countries. The establishment during the latter half of 1918 of oil mills absorbed the greater part of the copra produced locally.

Before the year 1918 copra was exported mainly to the United States and France, where it is crushed and manufactured into oil. The general scarcity of tonnage caused by the war affected the exportation of copra, and it was found much more profitable to establish oil mills in the Philippines and export the finished product instead of the raw material.

Copra is a bulky product, while oil is heavy and compact and is much more handy to transport. For instance, a vessel loaded with ten

thousand tons of copra will supply the world with about six thousand tons of coconut oil, but loaded with oil itself, that same vessel will take away some sixteen thousand tons. The saving, therefore, in freight is tremendous.

An enormous increase in the demand for vegetable oil caused by the depletion of the war supply of animal fats raised prices to unprecedented figures.

During the war coconut oil was used in making glycerine, which entered into the manufacture of explosives. Coconut oil is now used for butter substitutes, laundry and toilet soap, vegetable lard, salad oil, etc.

Copra Cake and Coconut Oil.

Copra cake is the meat of the coconut after the oil has been expelled. It is used for feed of cattle, poultry and hogs. Also as fuel and fertilizer.

There are now in operation in the Philippines about forty oil mills, with a daily capacity of about two thousand tons of oil.

The greater part of the oil produced in the Philippines enters the United States in the Pacific Ports, especially San Francisco. There are extensive storage facilities along the Pacific Coast at San Francisco, Seattle and Portland.

Great as has been the development of the industry during the past three years, the Philippines are to-day only at the threshold of her economic development. Coconut oil has come to stay in the world's markets. It is fast replacing animal fats and even other vegetable oils. The uses to which it can be put are increasing every day. With millions of acres of idle lands specially suited to coconuts in the Philippines, this rich tropical Archipelago will always lead the world in the production of this commodity.

The investor's opportunities in the coconut industry are in the establishment of coconut plantations rather than in the manufacture of coconut oil. There are now more oil mills than copra to be had, with the result that keen competition has caused the prices of copra to rise to unprecedented heights. As it takes at least six years for the coconut to get into bearing, the supply of copra cannot be immediately increased to cope with the increased demand. The small investor can purchase a piece of land in the Philippines, start a coconut grove, and after six years he will be assured of good returns which will increase year after year. Due to the permanency of the crop and the very little amount of care it demands, the investor is assured a good income during his lifetime and that of his grandchildren and great grandchildren.

ESTIMATE FOR DEVELOPMENT OF 2,500-ACRES COCONUT PLANTATION, UTILIZING HEMP CULTIVATION TO FINANCE COCONUT'S DEVELOPMENT IN DAVAO, COTABATO, LANAO OR ZAMBOANGA PROVINCES.

By Lt. Col. H. F. Cameron,
Engineers Corps, U. S. Army.

The essentials for a successful coconut plantation as pertains to maximum bearing are as follows:

(a) Well drained soil with water table near the surface. Low-lying land (over 100 feet above sea level to be avoided), near ocean.

(b) Irrigation to carry tree production through droughts and to increase number and quality of nuts.

(c) Freedom from winds which tear the flowers, nuts and even fronds from the trees in latitudes above 8 degrees.

(d) Protection from wild hogs, rhinoceros beetles and bud rot.

(e) Dependable labor.

(f) Well-distributed rainfall.

(g) Temperature of 70 degrees Fahrenheit and over.

(h) Good transportation facilities.

(i) Efficient management.

All these necessary economic factors to success prevail except b, d, h and i, which are dependent upon the management and his backing.

The uses of coconut oil and its by-product, the meal cake, are increasing rapidly.

A careful research through the library and files of the Department of Foreign and Domestic Commerce, Washington, D. C., in addition to personal investigations made by the writer in the West Indies, Hawaii, Borneo and all over the Philippine Islands, failed to disclose any tropical countries in the world where such extraordinary production results obtained as those in the above named provinces of the Philippines. All statistical tabulations show that in tree production the Philippines rank first, with an average of 90 nuts per tree year. Eight year old trees in the irrigated section of a hemp plantation, in which the writer is interested, have a record of 180 nuts a year—one mile from sea water, 30 feet above sea level, a 15-foot alluvial soil on a clay base, and having full advantage of rain and irrigation moisture.

The estimated number of nuts to make a picul (137½ lbs.) of coprax vary from 175 in Davao (Mrs. Burchfield's record), 200 at San Ramon Penal Colony (Coconuts—The Consuls of the Pacific), to 300 to 400 in Laguna and Tayabas Provinces, Philippines.

Manila hemp fibre can be grown nowhere else in the world. It is a staple article of commerce. Its only known enemies are drought, wind and wild pigs or deer. These losses by wind or typhoon north of these areas are an annual occurrence—but not here; the drought insurance necessitates irrigation, and the losses by animals can be prevented by fencing. Labor for stripping abaca is a prime necessity, but in a development of this nature the supply secured for the preliminary development can easily be converted to stripping as needed. Irrigated hemp reaches stripping age inside two years and will produce 15 to 20 piculs of fibre a year per acre.

The procedure to develop 2,500 acres of coconuts is for the seed coconut beds to be started while hemp suckers are being planted. The coconuts are planted on 30-foot centers while the hemp is planted in east and west lines—to permit the sun to have full play—24 and 6 foot centers alternately north and south and 8-foot centers east and west. By this method the maximum of 400 hills of hemp and 50 coconut trees per acre will result. The hemp production begins at eighteen months after planting, while coconuts begin at the fifth year, the hemp thinning out as coconuts age.

The estimated unit (2,500 acres) development cost and returns outlined is taken from actual records in Davao Province of present-day conditions. To be conservative, coconut trees are assumed to produce 90 nuts a year, or one-third of a picul of coprax a tree per year (16 piculs a year an acre), while hemp is estimated at 15 piculs per acre a year—this for irrigated areas which insure regular production. Coprax market value is assumed at $5, though it seldom reaches the low level, while hemp market value is assumed at $15 for Davao grades (our prices averaged $37.75 in 1917, $25 in 1918 and $21 for the first quarter of 1919), and interest on money invested at 6 per cent. The profit values at these figures are $3 a picul (a dollar a tree a year) for coprax and $3 a picul for hemp.

The actual plantation cost to harvest and market, including overhead, of the hemp (AA and BB grades for Japanese trade) on a 100,000 hill hemp plantation in Davao Province is $12 a picul, while to harvest and market coprax is $2 a picul on a small plantation but cheaper on a large, modern-equipped plantation.

This 2,500 acres that will be developed in three years—1,000 acres first year and 750 each of the next two following years is purchased public land.

FIRST YEAR.

	Debit.	Credit.
First payment on 2,500 acres of land at $2	$1,000 00	
Clearing, plowing, etc., 1,000 acres at $2	2,000 00	
Purchase of 50,000 coconut seed at $0.06	3,000 00	
Purchase of 400,000 hemp seed at $10 M	4,000 00	
Planting of 50,000 coconuts	250 00	

		Debit.	Credit.
Planting of 400,000 hemp		$1,200 00	
Fencing 1,000 acres at $3		3,000 00	
Tools and animals		10,000 00	
Superintendence and Administration		20,000 00	
Superintendent	$8,000 00		
Three Assistants at $1,800	5,400 00		
Cashier and Bookkeeper	2,400 00		
Office force and stationery	2,500 00		
		18,300 00	
Miscellaneous—Land surveys, roads, wharf, launch, etc.		15,000 00	
Supply, drainage, doctor, medicine, insurance, etc.		15,000 00	
Irrigation system		20,000 00	
Superintendent's bungalow		2,000 00	
White men's quarters		1,500 00	
Laborers' barracks, first year		1,500 00	
Office building and store with stock		5,000 00	
Tool and cattle shed		1,500 00	
Hospital and equipment		5,000 00	
Interest on $100,000 at 6 per cent		6,000 00	
		$100,250 00	
REVENUES.			
Profit from store		.....	$10,000 00
		$100,250 00	$10,000 00
Deduct credit		10,000 00	
		$90,250 00	

SECOND YEAR.

		Debit.	Credit.
Second payment on 2,500 acres		$1,000 00	
Clearing, plowing, etc., 750 acres at $2		1,500 00	
Maintenance of 1,000 acres at $1.25		1,250 00	
Purchase of 35,000 coconut seed at $0.06		2,100 00	
Purchase of 300,000 hemp seed at $10 M		3,000 00	
Planting 35,000 coconuts		175 00	
Planting 300,000 hemp		1,500 00	
Fencing 750 acres at $3		2,250 00	
Tools and animals		5,000 00	
Superintendence and Administration		20,000 00	
Laborers' barracks		1,500 00	
Irrigation maintenance		3,000 00	
Miscellaneous		10,000 00	
Interest on $150,000 at 6 per cent		9,000 00	
		$61,275 00	
REVENUES.			
Profit from store		.....	$10,000 00
		$61,275 00	$10,000 00
Deduct credit		10,000 00	
Cost for second year		$51,275 00	

THIRD YEAR.

		Debit.	Credit.
Third payment on 2,500 acres		$1,000 00	
Clearing, plowing, etc., 750 acres at $2		1,500 00	
Maintenance of 1,750 acres at $1.25		2,187 50	
Irrigation maintenance		5,000 00	
Purchase, planting, etc., of 35,000 coconut and 300,000 hemp seed		7,000 00	

	Debit.	Credit.
Animals and tools	$3,000 00	
Fencing 750 acres at $3	2,250 00	
Sorting and baling sheds for hemp	7,000 00	
Superintendence and Administration	20,000 00	
Miscellaneous	10,000 00	
Interest on $200,000 at 6 per cent	12,000 00	
	$71,937 50	
REVENUES.		
Profit from store	.....	$10,000 00
Profit from six months' hemp cleaning, one-half (1,000 acres—15 piculs × $3)	.....	22,500 00
	$71,937 50	$32,500 00
Deduct credit	32,500 00	
	$39,437 50	

FOURTH YEAR.

Fourth payment on 2,500 acres	$1,000 00	
Animals and tools	3,000 00	
Maintenance of 2,500 acres at $1.25	3,125 00	
Irrigation maintenance	6,000 00	
Superintendence and Administration	20,000 00	
Miscellaneous	10,000 00	
Interest on $200,000 at 6 per cent	12,000 00	
	$55,125 00	
REVENUES.		
Profit from store	.....	$10,000 00
Profit from 1,750 acres at 15 piculs (26,250 piculs at $3)	.....	78,750 00
	.....	$88,750 00
Deduct expenditures	.....	—55,125 00
Balance (represents 17 per cent. on $200,000 capitalization)	.....	$33,625 00

FIFTH YEAR.

Final land payment	$1,000 00	
Maintenance, 2,500 acres	4,000 00	
Animals and tools	3,000 00	
Superintendence and Administration	25,000 00	
Irrigation maintenance	6,000 00	
Miscellaneous	10,000 00	
Interest on $200,000 at 6 per cent	12,000 00	
	$61,000 00	
REVENUES.		
Profit from store	.....	$10,000 00
Hemp from 2,500 acres at 15 piculs—37,500 piculs—37,500 piculs at $3	.....	112,500 00
	.....	$122,500 00
Deduct expenditures	.....	—61,000 00
Balance (represents 30 per cent. on $200,000 investment)	.....	$61,500 00

SIXTH YEAR.

	Debit.	Credit.
Maintenance of 2,500 acres coconuts	$5,000 00	
Irrigation maintenance	6,000 00	
Superintendence and Administration	25,000 00	
Animals and tools	3,000 00	
One-half cost coprax dryer construction	10,000 00	
Miscellaneous	10,000 00	
Interest on $200,000 at 6 per cent	12,000 00	
	$71,000 00	
REVENUES.		
Profit from store	.....	$10,000 00
Hemp from 2,500 acres at 12 piculs (hemp thinning out) —30,000—profit at $3 a picul	.....	90,000 00
	.....	$100,000 00
Deduct expenditures	.....	71,000 00
Balance (represents 15 per cent. on $200,000 investment)	.....	$29,000 00

SEVENTH YEAR.

Maintenance of 2,500 acres of coconuts	$5,000 00	
Irrigation maintenance	6,000 00	
Animals and tools	3,000 00	
One-half cost on coprax dryer	10,000 00	
Superintendence and Administration	25,000 00	
Miscellaneous	10,000 00	
Interest on $200,000 at 6 per cent	12,000 00	
	$71,000 00	
REVENUES.		
Profit from store	.....	$10,000 00
Hemp from 2,500 acres at 9 piculs per hectare—22,500 piculs—profit, 22,500 at $3	.....	67,500 00
Coprax from 39,000 trees at one-third picul per tree—16,333 piculs—profit, 16,333 piculs at $3	.....	48,999 00
	.....	$126,499 00
Deduct expenditures	.....	71,000 00
Balance (represents 27 per cent. on 200,000 capitalization)	.....	$55,499 00

NOTE.—Would advocate developing plantation from all capital rather than part income, using hemp income for dividends on capitalization.

CONCLUDING REMARKS.

The plantation in full bearing, say tenth year, will have 120,000 coconut trees—50 acres reserved for roads, buildings, etc.

The annual expenditure now should not exceed $55,000, while the profit should at a minimum be $120,000 (trees × one-third piculs × $3 profit per picul)—$55,000 = $65,500, or approximately 32 per cent. on a $200,000 capitalization.

This profit can be greatly increased by an oil mill installation that would provide for using products of neighboring planters as well, and for acting as purchaser for neighboring small planters.

The actual value of a coconut plantation fully developed in coconuts will be close to $750,000 judging from prices that the Japanese are paying for Davao plantations.

From recent "British and Australian Report on the Trans-Pacific," the following data on Fiji and Solomon Islands was obtained: "Trees (coconut) bear in four years and full bearing in six years, and produce eight to ten hundredweight (Spiculs) of coprax a year per acre. The average price is 21 pounds 6 shillings and 3 pence per 1,000 kilograms (2,220 lbs., or 17 piculs), with a profit of 10 pounds a ton (16 piculs)." This is slightly over $3 a picul. Common estimates in the Philippines are by trees, each tree to give a net return from $1.50 to $2.50 per year.

In the Solomon Islands swamp ground is planted with ivory nuts with large profit. From "Coconuts—Consuls of the Pacific," are found statements that coconut plantation development in the Federated Malay States costs 35 to 40 pounds ($175 to $200) an acre, and in the West Indies about $200. Data as to land costs and as to class of land developed do not permit of a fair comparison.

PINEAPPLES.

By Helene H. Wilson,

Publicity Secretary, Philippine Commercial Agencies.

Philippine pineapples are no longer an experiment. They are of good size and sweeter in flavor than even those of Hawaii, when properly cultivated.

Land Available.

The extensive uncultivated sugar cane lands have been found to be well adapted to pineapple growing. The Government of the Philippines leases through the Bureau of Lands parcels of 100 hectares each (2.471 acres) at a cost of 25 cents per hectare, or approximately 12½ per acre per annum. It is also selling land at from $4 to $10 per hectare.

Preparing the Soil.

Pineapples require a sandy, friable, or loamy soil. They should never be planted in heavy clay. The chocolate-colored clay soil will grow pineapples but the expense of cultivation is much higher than when planted in sandy or loamy stretches.

Before planting the soil should be plowed at least 8 inches deep. This operation should be repeated three times, and the area should then be harrowed twice.

Moisture Demanded by the Plants.

An annual rainfall of from 50 to 65 inches evenly distributed throughout the twelve months is required for successful growing of

pineapples. Where this amount of rainfall is not recorded the land should be irrigated. If the tract is adjacent to one of the numerous rivers or creeks this is not a difficult proposition. However, in many instances it will be necessary to sink wells for irrigation purposes. A good well will cost on the average of $50.

Varieties of Pineapples Best Suited to the Philippines.

The Smooth Cayenne variety has proven to be best suited to Philippine soil and climatic conditions and for commercial purposes.

In Mindanao pineapple planters, even with slight care, and none too careful cultivation, produced fruits weighing from 7½ to 8 pounds. These are too large for canning purposes; as nothing over a 4½-pound fruit is desired for canning purposes.

Other varieties which have been successfully tried out are Queen, Cabezona, Sugarloaf and Abaka.

Methods of Cultivation.

The use of tractors for cultivation, as well as preparation of the soil, is advocated. A 12 H. P. tractor is well adapted for the preparation of the soil and a small motor plow of from one to two H. P. is especially suitable for cultivation, and also for making furrows where irrigation is necessary.

Estimate of Cost of Establishment of a 20-Hectare Pineapple plantation.

Land at $10 per hectare (if purchased)	$200
Preparation at $12.50 per hectare	250
Seeds	250
Planting	500
Cultivation at $5 per hectare (for each crop)	100
Irrigation at $5 per hectare (for each crop)	100
Total	$1,400

Labor.

Laborers, who have been trained in the pineapple plantations and canneries of Hawaii, are to be found in practically all sections of the Philippines. These men know their business and with competent supervision may be depended upon to do their part.

Transportation.

The Manila Railway Co. offers good inducements in the way of rate terms to pineapple growers. On the other hand, if the plantation

is located too far away from the railroad it is well to provide for motor transport.

Markets.

The fruit is popular in the local markets, also in China and Japan. A large importing firm of San Francisco has offered to act as agent for all Philippine pineapple products shipped into the United States markets.

The Philippine pineapples have less acid contents and require less sugar for preservation purposes than those produced in other tropical countries.

PHILIPPINE COFFEE.

By Fidel A. Reyes,

Director, Bureau of Commerce and Industry.

The rise and final decline of the coffee industry in the Philippine Islands offers a very interesting study. Prior to 1890, coffee was an important product of several provinces of the Islands and constituted a source of considerable wealth in these sections. In 1890 and for several preceding years it ranked fourth in order of importance among exports, being in value only a little lower than tobacco and representing the following percentages of the entire export values: 7.4 per cent. in 1890, 7.1 in 1889, 7.7 in 1888, 8.3 in 1887 and 5.3 in 1886. Subsequent to 1890, due to the devastation of coffee plantations by insects and diseases, Philippine production rapidly diminished and finally almost ceased. Exports of coffee in 1893 were only one-half of 1 per cent. of all exports, and since that time its production and exportation have been merely nominal. At present, according to local dealers, there is no coffee of native growth on the Philippine market. In what was at one time one of the chief sources of the world's supply, only imported green and prepared coffees are found.

It was in south central Luzon that Philippine coffee was produced in greatest quantities prior to 1891. Plantations covering thousands of acres existed in the Provinces of Laguna, Batangas, Cavite and Tayabas, and some in Misamis and Cotabato, in Mindanao Island; but Batangas, in the central part of Luzon, led all the provinces in this crop. That the production of coffee was enormously profitable is testified to not only by living planters, but by evidences of decadent wealth still visible in the coffee-growing centers. Since 1891, however, its history has been only a repetition of that of all coffee-growing countries in the Orient invaded by the leaf spot fungus and root borer.

Philippine coffee compares well with that of Java or Martinique, and there are certain localities capable of producing coffee which,

according to experts, can be compared only to that of Mocha. The natural conditions of the Philippines for growing this crop are unexcelled elsewhere in the world, so that the possibility of the industry's re-establishment offers very bright prospects. The collapse of the industry was not the fault of the country, but of those engaged in its production. If the producers will only profit by the example of Java, once disease-resisting varieties have been planted, undoubtedly coffee will resume its former flourishing state in the Islands.

Java was, until 1880, the second largest coffee-producing region of the world. Then came the same disease which a little later swept the coffee plantations of the Philippines as if by a fire. The production of Java coffee was reduced from a surplus of 1,000,000 pounds to barely enough for home consumption.

Dutch planters interested in the maintenance of the plantations brought careful, scientific treatment to the then existing conditions of blight and insect diseases. They have so far re-established their coffee industry that it now produces an annual output of nearly 40,000,000 pounds and commands the highest prices in the markets of the world. The Dutch producers of coffee in Java solved the problem by planting disease-resisting varieties, largely effecting the restoration of the industry without recourse to other more difficult attempts to hold in check the disease by application of sprays.

Similar methods applied in the Philippines would result in the re-establishment of the coffee industry of these Islands. The large areas known to be available for successful cultivation suggest that with proper attention they may be able to produce a considerable share of the $75,000,000 or $80,000,000 worth of coffee imported into the United States each year.

The following table gives the quantities and values of coffee exports from 1880 to 1889, the period when this product was sent abroad in considerable amounts. Values are given in pesos, as in other tables in this article:

Year.	Kilos.	Value.
1880	5,129,777	1,363,957
1881	6,565,754	959,347
1882	5,602,941	1,167,095
1883	7,622,109	1,284,405
1884	7,629,564	1,471,014
1885	5,467,850	990,416
1886	7,136,303	1,354,347
1887	4,347,947	2,093,510
1888	6,389,253	2,033,097
1889	6,310,635	2,474,210

Since 1889 no data on Philippine coffee production have been available except for the years 1910 to 1912, when the production was 72,254

and 65,948 kilos, respectively. This may be explained by the fact that coffee was grown principally for experimental purposes—to see if the plant would produce berries or not—rather than for commerce.

The amount of production might be judged, however, from the Bureau of Customs reports, which show that enough was produced to allow some margin for export, although this so declined that in 1916 it amounted to only one peso. The export figures for the fiscal years ending June 30, from 1899 to 1912, were as follows:

Year.	Kilos.	Value.
1899	....	24,102
1900	....	3,112
1901	....	13,232
1902	....	5,758
1903	....	2,756
1904	....	5,586
1905	....	5,104
1906	....	3,598
1907	....	3,184
1908	3,030	2,452
1909	1,454	1,138
1910	1,350	970
1911	738	672
1912	610	576

On the other hand, the importation of coffee has gradually increased from year to year, until in 1917, 1,406,612 kilos were brought in, at a value of 837,252 pesos. The total value of coffee imported into the Philippine Islands since 1899 amounts to 6,866,793 pesos, as is shown below:

Year.	Quantity.	Value.
1899	153,857 lbs.	68,430
1900	24,358 lbs.	5,214
1901	22,412 lbs.	6,550
1902	998,198 lbs.	178,534
1903	777,557 lbs.	123,472
1904	396,857 lbs.	70,804
1905	1,252,736 lbs.	229,156
1906	1,057,884 lbs.	183,886
1907	1,451,893 lbs.	278,800
1908	1,726,088 lbs.	331,590
1909	2,023,217 lbs.	402,180
1910	2,632,041 lbs.	558,988
1911	1,673,364 lbs.	408,406
1912	2,234,594 lbs.	640,346
1913	2,137,430 lbs.	673,249
1914	1,106,621 kilos	694,768
1915	879,194 kilos	484,781
1916	1,104,413 kilos	690,332
1917	1,406,612 kilos	837,252
Total		6,866,893

Coffee requires a climate whose average temperature ranges between 16 and 24 degrees Centigrade, standing next to sugar cane in its high heat requirement. In localities having both heat and moisture, its growth is stronger and more luxuriant, as is manifested in various ways. In very hot climates the coffee plant grows well, but needs the shade of some other suitable tree, whereas in cooler climates it thrives best without this protection. The soil most suitable for its cultivation is one that is light and moist, but not marshy. Reddish soils, somewhat sandy, or black soils, without too much clay, are adaptable. If the land is virgin soil it should be thoroughly cleared, plowed deeply two or three times, and then harrowed; if the land is old it should be well fertilized.

Philippine coffee, though stated by some to rival in quality that of Java, does not seem to have received such recognition in the markets of the world. Prices during the years of highest production were only about 7 cents a pound. On account of the diminishing production of the latter 80's, however, prices showed great increases, and export values, in spite of reduced quantities, came to exceed 3,000,000 pesos, representing an importance and degree of prosperity for the industry in tragic contrast with the single peso's worth of coffee exported in 1916.

The chief consumers of Philippine coffee have been Spain, the United Kingdom and the United States, together with a confused but important China-Hong Kong trade. Spain has been a consistent consumer when she could get the product, and in the period of greatest and declining production, her share of the total exports ranged from one-third to two-thirds. The China-Hong Kong trade has been of about equal importance to that of Spain, though in the reduced figures of the early 90's it amounted only to about half the Spanish. The United Kingdom was the largest consumer of Philippine coffee during the greater part of the 70's, but of the increased quantities of the 80's she took smaller shares. The United States' purchases were heaviest in earlier times, reaching 1,359,707 pounds in 1866. After 1880, in but the single year of 1883 did they amount to as much as 100,000 pounds. Of the insignificant exports since American occupation, the States have taken about a third, China being the largest consistent purchaser of the quinquennial periods.

Much has been said recently of the revival of the industry and of the aid of an American import duty on coffee in connection with free trade for the Philippine product as a means to this end. The disposition in certain circles is to treat this once profitable industry as an asset in the plans under consideration for bringing prosperity to the Islands. It may be so regarded, in a way, for the rich returns of the coffee plantations and the suitability of the soil and climate are matters of

record; but it is to be borne in mind that coffee plantations, with their rich returns, are of slow growth, requiring outlays of capital and from six to twelve years of patient attention and waiting for the first realization of these returns. Extensive investments of this character do not seem probable, with the memory of the calamity of fifteen years ago still fresh, and especially in view of the fact that scientific research seems to have failed thus far to find a means of successfully combating the scourges that have destroyed the industry. Not until some means are found to prevent the repetition of that disaster, and even then, not for some years, does it seem probable that there will be any large return of confidence and capital to the planting of coffee on such a scale as to make it again an important factor in the agricultural wealth of the Islands. The future of the Philippine coffee industry seems for the present to be in the hands of the scientist and the agricultural expert.

Particular interest is therefore attached to the importation of coffee seeds into the Islands, and the final outcome of experimental plantings under the control of the Bureau of Agriculture will probably have a strong bearing on the future of this great potential industry. Circumstances leading up to the inception of this planting enterprise were the outgrowth of petitions addressed to the Bureau of Agriculture, requesting that efforts be made to re-establish this once dominant crop. Provincial nurseries have been established throughout the Islands, the main aim of which is to show the superiority of the "robusta" and the "liberica" species, both blight resistant, over the "arabica."

With the successful development of these reconstructive enterprises, and considering the popularity of coffee as a beverage at home and abroad, there should be little doubt that the industry will some time resume its former flourishing state. The following statistics of the consumption of coffee in the leading countries in 1904 show what a vast market is open the world over for this product. It is safe to say that consumption has increased rather than decreased since that time:

	Pounds.
United States	960,879,000
Germany	396,205,000
France	167,552,000
Belgium	125,411,000
Austria-Hungary	108,687,000
Holland	28,930,000
United Kingdom	28,783,000
Canada	6,189,000

HEMP, THE PREMIERE INDUSTRY OF THE PHILIPPINES.

By Arsenio N. Luz.

Hemp is considered the première industry of the Philippine Islands, not only because it occupies the front rank of the major exports of our country, but also because nature granted us through climatic and soil conditions the natural monopoly over hemp or "abaca" growing.

Hemp represents millions of dollars in investment and revenue and provides a living for two million Filipinos or nearly one-quarter of the entire population. The importance of this industry is naturally measured by the volume of production and export and to this end we are giving the official statistics showing each annual production by provinces for the years 1910, 1911, 1912, 1913, 1914, 1915, 1916, 1917 and 1918 on page 38.

Hemp is a fibre obtained from a banana-like plant known as "abaca," which grows only in the Philippine Islands. It is manufactured into high grade cordage and used in shipping and construction operations throughout the world.

Practically all Manila hemp is shipped and distributed through the New York and London markets. In pre-war times 40 per cent. went to the United States, 40 per cent. to the United Kingdom and 20 per cent. to the rest of the world, mostly Japan. War conditions dislocated these percentages and during the year 1917 55 per cent. of this Manila fibre was exported to the United States, 34 per cent. to the United Kingdom and 11 per cent. to the rest of the world.

Previous to American occupation, the entire hemp business of the Philippines was in the hands of a few Manila firms, almost exclusively British. During the past 20 years American and Filipino firms have entered the market and now control one-third of the hemp business, dealing principally in the medium and higher grades ("I" and above) used in this country. British firms still control the bulk of the trade in the lower grades ("J" and below) used in the British and Continental markets.

Prior to the war demands and consumption were in the proportion of 40 per cent. of the higher grades and 60 per cent. of the lower. The war demand stimulated production of the higher grades to 70 per cent. of the American and 30 per cent. of the British grades late in 1917.

It is to be noted that the usages of Manila hemp have multiplied and quite a portion of this fibre is used in the manufacture of clothes for local consumption, hats and slippers, only to mention the most important industrial uses in the Island. Braided abaca is also exported, mainly to Japan and Europe, to be converted into dry goods.

Provinces.	1910, Kilos.	1911, Kilos.	1912, Kilos.	1913, Kilos.	1914, Kilos.	1915, Kilos.	1916, Kilos.	1917, Kilos.	1918, Kilos.
Agusan	1,553,610	1,574,609	1,162,846	375,716	(a)	(a)	(a)	747,632	897,762
Albay	19,996,740	52,414,137	48,127,933	33,722,957	38,896,222	44,182,744	33,339,514	26,424,985	26,641,525
Ambos Camarines	17,027,027	21,787,222	20,342,678	23,611,096	26,824,496	30,959,913	23,840,757	19,230,292	19,431,429
Antique	132,192	57,241	60,051	80,427	48,030	156,151	220,101	220,178	233,422
Batangas	124,223	183,045	266,559	262,926	299,561	287,766	267,512	267,993	342,580
Bohol	1,474,800	1,199,916	1,173,683	566,177	315,538	299,099	252,062	386,695	516,276
Capiz	906,309	1,181,383	1,089,121	1,128,791	589,476	1,027,284	1,723,999	1,725,806	1,063,851
Cavite	747,615	1,734,758	1,882,110	1,634,054	1,225,661	1,338,902	2,056,067	2,189,057	2,588,049
Cebu	2,584,015	2,758,269	1,625,900	741,200	1,008,812	1,372,059	1,579,718	1,959,188	1,946,574
Davao	(a)	(a)	(a)	(a)	(a)	.....	.....	7,573,543	7,085,358
Iloilo	458,815	470,264	477,927	235,572	164,017	223,005	235,361	336,873	455,243
Laguna	837,620	701,948	987,844	978,606	583,342	836,907	1,901,055	2,151,583	1,883,398
Lanao	(a)	(a)	(a)	(a)	(a)	.....	.....	98,289	124,384
Leyte	37,926,977	25,682,663	22,919,797	17,119,652	16,438,827	18,321,210	29,142,758	35,536,190	39,237,577
Mindanao and Sulu	8,592,386	9,324,442	8,696,181	9,279,157	7,148,349	7,228,129	4,205,324	315	765
Mindoro	327,572	531,932	743,579	927,876	395,751	288,330	500,895	1,685,979	1,643,885
Misamis	7,055,664	8,868,852	7,693,455	6,495,718	3,476,802	3,515,375	3,946,320	5,850,816	5,157,823
Occ. Negros	1,064,371	1,038,438	874,565	692,272	159,135	233,515	370,121	312,847	479,067
Oriental Negros..	10,780,012	2,341,452	2,108,117	1,851,333	1,610,661	2,501,215	2,308,129	2,692,093	3,312,183
Palawan	.....	.....	682	2,100	2,768	.....	.....	.....	1,617
Romblon	.....	.....	.....	.....	.....	.....	.....	.....	560,288
Samar	18,901,124	14,938,828	13,385,746	13,297,980	8,108,458	11,420,265	12,697,899	17,418,456	17,262,891
Sorsogon	24,488,629	20,651,884	20,177,765	23,331,195	26,876,377	25,545,769	29,841,202	25,128,934	25,936,648
Surigao	3,913,151	2,713,235	3,767,112	2,627,695	2,144,905	2,982,104	2,744,924	5,553,734	5,812,093
Tayabas	9,559,290	1,725,080	1,909,727	1,557,832	1,318,375	1,572,714	1,582,560	1,534,476	1,819,577
Zamboanga	.....	.....	.....	.....	.....	(a)	(a)	1,930,801	2,439,379
Total production	168,452,142	171,879,598	159,473,376	140,520,332	137,635,503	154,192,492	152,756,278	160,953,355	166,863,644
Total value ...	₱26,952,343	₱27,500,736	₱28,705,208	₱32,319,676	₱29,968,009	₱30,420,742	₱42,767,339	₱63,598,136	₱92,493,224

(a) See Mindanao and Sulu.
One metric ton (M. T.) equals 1,000 kilos.

The standard abaca or Manila hemp grades are divided into five groups according to the cleanings of the fibre as follows:

Group I includes grades A to S-3, inclusive. This group embraces fibre of excellent cleaning, which can be strictly termed as pure fibre, although it has a tendency of being sometimes slightly strippy in the grades E, S-2 and S-3.

Group II includes grades F to H, inclusive. The group embraces fibre of good cleaning, which is slightly strippy, but which for all practical purposes can be used as pure fibre.

Group III includes grades I to K, inclusive. This group embraces fibre of fair cleaning, and which is distinctly strippy, and consequently of a harsh texture and "bold" size.

Group IV includes grades L to M, inclusive. This group embraces fibre of coarse cleaning or coarse strips.

Group V includes grades DL to Y, inclusive. This group embraces woody fibre (DL and DM), waste fibre (OO and T), or damaged fibre (Y).

The percentage of hemp in the total exports of the Philippine Islands is the following:

Year.	Percentage.	Value.
1909	48.38	₱33,792,000
1910	14.55	32,950,622
1911	32.31	28,920,254
1912	14.19	4,151,342
1913	44.21	42,242,168
1914	39.42	38,389,630
1915	39.65	42,678,200
1916	38.17	53,384,593
1917	48.96	93,615,559
1918	43.04	116,393,100
1919	42.45	53,723,052

The decided slump of the hemp market for this year was due to greater degree than any of the other major exports of the Philippines to the sudden termination of hostilities in 1918. It was also due to certain business manipulations in this country and abroad. Immediately after the signing of the armistice in November, 1918, certain New York brokers, supposedly acting for large and powerful interests in the background, made a dead set to break the prices and lower the market for Manila hemp. Their efforts, however, were not altogether especially directed against Manila hemp, but it was necessary to break the market for this article in order to force down the price of Mexican sisal, which is so largely used in the manufacture of binder twine. Through a long series of wily manipulations, sisal has been forced down from 19 cents gold per pound to 9 cents gold per pound. On account of these manipulations the Yucatan State

Agency for marketing sisal was reported to be in bankruptcy at that time with unsold stock of over six hundred thousand bales left on its hands. Manila hemp has, of course, suffered, but much of the loss suffered by Philippine interests is attributed in a great measure to the unstability of the trade market just before and after the armistice was signed, some shippers having had to pay as high as $17 per bale from Manila to the Pacific Coast, while others were able to obtain rates almost at the same time of $2 per bale. This wide difference in rates had a demoralizing effect on the hemp market, enabling as it did the shipper at $2 per bale to greatly undersell those shippers who paid higher rates.

These are briefly the main causes of the slump of the hemp market during last year. These causes, being temporary and artificial, are not expected to continue and at present hemp is picking up again and conditions are being normalized.

It is a well-known fact that the best marine rope in the world is that made of Manila hemp, which is the finest fibre for this purpose, both in point of tensile strength and lengths of fibre. Needless to say, the demand will rapidly be increasing year by year.

The opportunities for the extension of the abaca industry of the Philippines are very promising. This will be the leading Philippine export industry for an indefinite period. Improved methods of culture and fibre extraction, which are now beginning to be put in use, will largely increase the production of fibre on some of the land already cultivated.

Large areas now being deforested are in every way suitable for abaca and are available for prospective planters. With but little or no danger from insect or plant diseases and with little or no competition from other countries, abaca is an imminently safe crop and affords one of the most profitable branches of agriculture in the Philippines.

RICE.

By Adriano Hernandez,

Director, Bureau of Agriculture, Philippine Islands.

In 1915 the Philippine Islands produced more than 8,000,000 sacks of rice, and imported less than 3,000,000. The imports came from Saigon and went chiefly to the southern portion of the archipelago. In 1919 the local supply from the 1918 crop approximated 16,000,000 sacks and the imports more than 2,000,000. This amount was not, however, equal to the total consumption of 1918, which was two sacks

per capita, or slightly in excess of 21,000,000 sacks. The area cultivated to rice is 3,420,350 acres.

The dual problem confronting the Islands at present consists in coping with increasing per capita consumption coupled with the larger demand due to growth of population, and in producing at the same time sufficient rice to take the place of decreased importations of this commodity, which have now fallen off owing to shortage in other markets. The per capita consumption may be reduced through educating the people to the use of substitutes, but this, like the building of Rome, can not be done in a day, and while it is being done the substitutes must be produced in large quantities. The Bureau of Agriculture has conducted a food campaign for several years and has had an influence, probably, upon the production of corn and root crops which will supplant rice in the population's diet. These crops are being produced in greater abundance than ever before, but, on the other hand, increased prosperity makes it possible for the people to live better than they did formerly, so the demand for rice keeps up and is even advancing.

The only possible solution lies in greater production, and, fortunately, every influence touching the industry is favorable to this purpose. Rice growing is one of the oldest activities of the Filipinos and one to which they have a natural inclination. Lands suitable thereto are fertilized and are renewed over large areas every year by deposits from flood waters. Capital available for agricultural ventures is increasing in amount, and the low price prevailing in the world's markets for certain staple crops of the Islands encourages producers of these staples to curtail their production and to give more attention to rice. Above all, large areas of public lands, well adapted to rice culture, are available, either for leasing or for homesteading.

The price of rice, too, though much lower than that current in Japan, China and elsewhere, is still very favorable and will probably be guaranteed by the Government as a further stimulus to production. When, recently, the Saigon market was cut off as a reliable source of supply, the Government broke the rising local market by establishing a maximum price and followed this action by an embargo on the export of existing stocks and the appointment of a dictator, the Hon Dionisio Jakosalem, Secretary of Commerce and Communications and a member of the Philippine Cabinet and Council of State. The consternation of the dealers and producers provoked by this drastic action was expected in all probability to be met with a guarantee of a minimum price for rough rice at harvest time.

The greater portion of rice grown in the Philippines is produced on the Island of Luzon, the chief port of which is Manila, the capital and metropolis of the Archipelago. Rice is grown in the valleys of

several large rivers in central Luzon and is transported to Manila both by railroad and water routes, the latter being the more advantageous, though not available to many production points. The rice is milled either at primary stations or at Manila, and the milling is done in nearly all cases by the use of modern machinery. Milling and distribution are largely in the hands of Chinese interests financed by British capital, the usual charge for the former operation being 15 cents gold per sack.

In recent years threshing machines have been sucessfully introduced, thus turning another phase of the industry over to modern methods. These machines are widely used throughout the Luzon valley, the usual rate for threshing being 8 to 10 per cent. of the crop. Many of the machines are owned by co-operative associations; others by millers, and sometimes installed at the mills; and still others by individual producers. They work without difficulty, but their use has the unfavorable result of throwing practically the entire crop upon the market within a period of a few weeks, so that the greater profits are not made by actual producers, but by dealers and millers. The price falls steadily in the few weeks following harvest; mills are glutted and means of traffic congested. At this unfavorable time the product passes out of the producers' hands. After the glut is off the market, that is, after the transfer of ownership to dealers and millers, the price turns upward, and various influences tend to keep it rising. Whereas producers make a small profit or merely cover production cost, dealers and millers profit generously. Development of an effective warehouse system would probably go far toward alleviation of the evils of the present practice.

The Bureau of Agriculture is bending great effort toward teaching better husbandry through an organization of farm advisers devoted to this purpose and by means of a division which is organizing rural credit associations among the growers so as to make them self assisting and independent of money advances from buyers. The most malevolent influence on the industry is the growers' almost universal habit of getting advances from buyers at the beginning of the cropping season. This obligates them, under formal contract, to sell their crop at a stipulated period and often at a stipulated price, fixed low enough to guarantee to the buyer a safe margin.

This year (this article was written late in 1910) as a step in its food campaign, the Bureau of Agriculture made use of a fund of 1,000,000 pesos for loans to rural credit associations at the rate of 6 per cent. per annum, taking joint notes of members of the associations as security. No untoward developments occurred, and it is anticipated that the Legislature will provide a similar fund for the year 1920.

This fund particularly aids smaller producers, whose lands are for the most part not under registered title and who, therefore, can not deal with banks. Large planters have the facilities of the Philippine National Bank at their disposal. No small part of the doubled production of the last five years is due to the Government's having made it easier for growers to obtain funds for extension of their operations. The movement has not gone far enough, however; it will require considerable development before the grower will be entirely relieved from the depredations of usurers and unprincipled middlemen.

On the lowlands, where the great bulk of the rice of the Philippines is grown, field machinery cannot be used to advantage. The grower must still depend, as for centuries he has depended, upon the carabao, or water buffalo, and the small plow. The only effectual improvement in this respect has been the introduction of steel plows instead of wooden ones. The former turn the soil better and run at a greater depth, but they are all one-animal plows, like the cruder wooden ones which preceded them.

Plowing begins after the opening of the rainy season, either in June or July. Seed beds are prepared first, for lowland rice is all transplanted. The fields are usually flooded by early rains, and plows and harrows work them into a muck. Plowing and planting are done in rain and mud, and both operations go forward together. Men, women and children in certain of the provinces all lend a hand in the transplanting, as they also do later at harvesting. Both tasks are made occasions for holidays, the happy farmers planting or harvesting to the music of mandolins and singing in busy chorus the ancient folk-songs of their neighborhoods. By harvest time the rains have ceased, and everything is brightness and sunshine. Harvest scenes are picturesque in the extreme and, though a scientific man, as exigency labels me, I would view the substitution of machinery for the old hand-gleaning methods almost with regret. The people are so carefree at the rice harvest! Such reunions, such fiestas, such dances and such songs!

Few planters have paid attention to the vital item of seed selection, and this neglect has been so general as to reduce the yield by a very marked degree, perhaps to 40 per cent. of what it is possible to attain. Consequently a great many varieties have been developed, though not all have justified their use by adequate, dependable yields. To correct this the Bureau of Agriculture has established a Division of Demonstration and Extension and has for several years conducted a campaign for scientific seed selection. Its field inspectors are charged with this work.

Most Philippine rice land is rich enough to yield 100-fold in favor-

able years and 80-fold in less favorable seasons. The average yield, however, is less than 40-fold. With elimination of unprofitable varieties and breeding up of profitable ones through means of seed selection—a practice which at last is becoming common—the yield will in time be brought to the height in keeping with the soil's fertility. Public school activities on school, farm and home garden and in elementary agricultural instruction in all primary and intermediate grades is a potent influence in this direction. The great majority of the public schools are established in rural and semi-rural centers.

On lowland rice fields flood water is controlled by means of dikes run at frequent levels. Irrigation receives particular attention from the Government and is being extended as rapidly as funds available permit. I have recently recommended an appropriation of 50,000,000 pesos for this purpose. Great dependence is at present placed upon the rainfall, which the dike systems are constructed to control and conserve. At times the rainfall is too great; at times it is too small. On the whole, decidedly too much depends on the will of Providence, and the rice industry will be on a much safer basis when the crops are grown entirely under irrigation.

Frequency of streams and availability of both surface well and artesian water make the establishment of irrigation systems entirely feasible. The Insular Government has made it possible for provinces and municipalities to vote bonds for this purpose, and every peso provided in this way is met by another from the insular Treasury. The Bureau of Public Works has a well-organized irrigation division, and its engineers supervise the governmental projects, this being an important activity of the Department of Commerce and Communications.

Much is being done through private enterprise. Not a few planters have installed centrifugal pumps or have had artesian wells bored for irrigation of their rice lands. Some find it possible to use their traction engines for pumping purposes, installing them either at the edge of a convenient stream or at wells.

Four other principal crops of the Islands are cocoanuts, sugar cane, corn and tobacco; but the area cultivated to rice is greater than the aggregate devoted to all these. However, sufficient rice is not produced yet.

The present production is being supplemented by culture of upland rice. In this, I am sure, there is much hope. Upland rice, unlike the lowland varieties, may be handled almost exclusively by use of machinery. If animals are used, these may be hitched in teams and made to pull larger plows, and larger planters may utilize tractor power for plowing, putting into tilth, seeding by means of drills, harvesting and threshing. Land is plentiful, as 15,000,000 acres of agricultural land are lying fallow, millions of acres of which are adapted to rice growing.

While upland rice cultivation in the islands may be said to have emerged from the experimental stage, it is being taken up these days on much broader lines than formerly and the use of machinery is being tested more carefully. One planter, for instance, is devoting 1,200 acres to upland rice, using machinery almost entirely and following cultural methods which have been developed successfully in California by experts formerly connected with the Bureau of Agriculture in the Philippines. His success will be an impetus of decided force in the extension of such activities.

Finally, with the co-operation of the Bureau of Labor and the Provinces of Mindanao and Sulu, much is being done towards extending rice cultivation in Mindanao, the second largest island in the Archipelago, with an area of 36,000 square miles. Agricultural colonies have been established there, and emigration is being encouraged from the thickly populated provinces of Luzon—the so-called Ilocos provinces—to the virgin valleys of the large southern island, where vast acreages of public lands are to be had either by homesteading or under lease. This movement has only just begun, but it is destined to continue and to grow, and when the potentialities of Mindanao in rice culture have been attained, or half attained, the Philippines will produce sufficient rice not only to supply itself but to export an abundant surplus of this prime necessity to other countries of the Orient. My memory goes back to a time when cultivation of sugarcane and cocoanuts was much less extensive, when the population was not nearly so wealthy and the metropolitan element not so dominant, and when, with the simple needs of the people of that time, the production of rice was greater than the demand.

But we are now in the modern era, specializing in sugar, hemp and cocoanut (copra) production and the like. Therefore, the situation presented must be met, and this can be done only by specialization in rice cultivation, a thing which the favorable market, the energy of the people, their love of the ancient industry and the foresight of the Government are gradually accomplishing.

RUBBER GROWING IN THE PHILIPPINES.

In the year 1917 Mr. Pearson, editor of the "India Rubber World," made a trip to the Philippine Islands for the purpose of investigating the rubber situation. The following is an excerpt of his very interesting report appearing in subsequent numbers of the "India Rubber World":

For nearly fifteen years there had been sporadic attempts at the cultivation of rubber on Basilan Island of the Philippine Archipelago. Unfortunately, for a time the chief interest centered about "Ceara

rubber," with some attention paid to "Castillao" and a very little to "Hevea." Thus, in 1909, Carl F. Miller had a considerable planting of Ceara which grew exceedingly well. These trees were tapped when they were three and one-half years old and about 8 inches in diameter. The result was about one-half ounce of rubber per tree.

Another Ceara planter, F. T. Winters, planted Ceara in 1906. The trees grew well, but it was not found profitable to extract the latex from them.

Incidentally, it might be noted that the Basilan Plantation Company began with Castilloa, which grew wonderfully, but when its relatively unsatisfactory product was discovered, it was abandoned entirely in favor of "Hevea."

The history of the Basilan plantation is of much interest. It dates back to 1905, when Dr. J. W. Strong, of Zamboanga, acquired some 115 acres, part of which had been cultivated and planted to coconut trees. At the outset he began the cultivation of Ceara rubber, interplanted with hemp. In 1907 the first planting of Hevea trees was begun, but it was more as an experiment than anything else. A year later more Hevea trees were added. In 1911 the Basilan Plantation Company was formed to take over Dr. Strong's holding. It was comprised of residents in the Philippines—Swiss, Germans and Americans. This gave the venture more capital, additional land, some 1,000 hectares of which was acquired from the Government. Hevea rubber and coconuts, especially the former, was then planted on a considerably larger scale. The new land was jungle, exceedingly rich and well drained.

The first real tapping took place in 1915. The number of trees tapped was 14,650 and the product was 12,932 pounds of excellent rubber gum. As is always the case when trees come into bearing, the tapping cost was high, being about 32 cents a pound. Rubber was low when the product was marketed, and the price paid was 51 cents a pound.

In 1916 the production was 32,982 pounds, at a cost per pound a trifle less than 24 cents for collecting. The rubber was marketed at 61 cents a pound.

At the time of my visit 32,000 trees were being tapped and the estimated yield of 51,000 pounds had already been exceeded. It is interesting to note that both for 1915 and 1916 the plantation showed a profit, an even better one than was expected. Nor is there any reason to doubt that as the 70,000 trees come into bearing and mature, profits will be greatly increased and costs lessened. These figures of increase which the company has prepared are exceedingly conservative and are largely exceeded each year. They are:

Estimate of Yield of Four to Twelve Year Old Trees.

0.60 pounds for trees 4 years old.
1.19 pounds for trees 5 years old.
1.50 pounds for trees 6 years old.
2.03 pounds for trees 7 years old.
2.91 pounds for trees 8 years old.
3.63 pounds for trees 9 years old.
4.17 pounds for trees 10 years old.
5.06 pounds for trees 11 years old.
6.22 pounds for trees 12 years old.

Labor can be secured from the nearby Island of Cebu. As there are already thousands of Hevea trees installed, seed may be obtained almost at one's door.

In this connection it may be interesting to note the comparative costs of bringing land into cultivation for rubber in the Philippines as compared with the present great rubber-producing countries. The figures representing the cost per acre are as follows: $50.94 in the Philippines; $73.60 in Sumatra; $109.94 in Java, and $137.42 in Federated Malay States.

The upkeep per acre costs approximately $18 in Mindanao and Sulu Provinces of the Philippines; $20 in Sumatra; $23 in Java, and $29 in Federated Malay States.

As to planting and growth, the following figures taken from the company's records are significant:

Planted in the Year:	Rubber.	
	Acreage.	Trees.
1910	51.9	8,920
1911	169.35	21,019
1912	34.7	3,848
1913	57.6	7,160
1914	12.5	1,871
1916	228.585	30,282
	554.635	73,100

It is interesting to note from the above table that 171 trees to the acre were planted in 1910; 124 trees in 1911; 110 trees in 1912; 124 trees in 1913; 149 trees in 1914, and 132 trees in 1916.

The annual growth of the trees, according to official measurements recorded by the company, is:

Block No.	Planted in Year.	Circumferential Growth in the Year After Planting. Third Year.	Fourth Year.	Fifth Year.	Sixth Year.
2	1910 inches.....	....	5.48	4.33	4.93
3	1912.....	....	6.65	....	....
5	1913.....	6.175	....	....	....
6	1910.....	....	6.75	4.85	4.65
9	1911.....	5.2	6.15	5.45	....
10	1911.....	4.85	5.95	5.65	....
11	1911.....	4.55	6.6	5.5	....
13	1911.....	5.15	6.25	5.5	....
15	1911.....	4.75	6.1	5.9	....
18	1913.....	7.2	....	....	....

The rainfall, as far as known, is always more than 90 inches. According to the Weather Bureau at Isabela the rainfall there for ten years was:

	Annual m.m.	Number of Rainy Days.
1903.....	1,659.9	156
1904.....	1,885.9	143
1905.....	1,103.	112
1906.....	1,811.1	144
1907.....	2,032.9	173
1908.....	2,220.	186
1909.....	1,970.6	184
1910.....	2,227.2	205
1911.....	1,539.6	123
1912.....	1,529.	129
1913.....	1,759.1	139
Average	1,794.1	153.1

Attitude of Government.

The Philippine Government is giving encouragement to rubber companies. Following is a cablegram recently received from the Secretary of Commerce and Communications:

"Government offers in Basilan and Mindanao rubber plantations situated near ports of entry of Cebu and Zamboanga and on routes of established coastwise commercial transportation service. Regions outside typhoon zone possess unsurpassed natural conditions for profitable production of rubber. Labor bureau gives facilities to planters. Matter of leasing on extremely favorable conditions whatever area required by bona fide rubber planting enterprises will be recommended to proper authorities. Dionisio Jakosalem, Secretary, Department Commerce and Communications."

THE SUGAR INDUSTRY OF THE PHILIPPINES.

By Cleve W. Hines.

Sugar cane has been grown in the Philippine Islands since time immemorial. Historians state that when the Islands were discovered by Magellan in 1521, he observed this plant among others grown by the natives near their houses for food purposes. This was on the Island of Cebu, where a certain variety has been grown for many generations, and it is not improbable that this was the one observed there by the discoverers of the Archipelago. It is one of the richest canes ever reported in any sugar country, although in yield it does not compare favorably with modern varieties, particularly those produced from seed during the last two decades.

Two other varieties, presumed to be indigenous, are the "Inalmon" and the "Tigbao Mestiza." The former is a very dark cane, with medium long inter-nodes and soft tissues and with a distinctive pleasant flavor, making it particularly well adapted for chewing. It is grown most extensively as a home industry in regions somewhat remote from the principal sugar districts.

The other plant, the "Tigbao Mestiza," is in fact not true sugar cane, *saccharum officinarum,* but a remote ancestor, *saccharum spontenum.* This is found in uncultivated regions of the Island of Negros and grows very profusely, invariably producing large stools. The sucrose (pure sugar) content is very low and the fiber high. The cane is dark purple in color. Of late years seedling varieties of superior quality have been imported, and the writer has produced numerous such varieties at the experiment stations of the Bureau of Agriculture, many of which offer extremely promising results.

The sugar industry of the Philippines was probably first conducted on a small commercial scale in some of the provinces on the Island of Luzon, near Manila. It is more than probable that it was introduced by Chinese, as is evidenced by such implements as the earthen jar or "pilon," granite rolls which came directly from quarries of China, and various implements and methods employed in antiquated mills, many of which are as much in vogue to-day as they were a century ago. The first authentic record of exportation of sugar is dated 1795, when some 296,219 pounds of crude sugar were shipped from the Philippine Islands to the United States. Finally the industry migrated to various other islands. In 1849 it was started on the Island of Negros by the Recoletos Friars. In 1854 exportations had grown to such an extent that they represented 33 per cent. of the total of goods sent abroad. From that time until the present day this industry has gradually increased in importance, but at no time was so extraordinary an interest

in its development shown as has been noted since the close of the recent war.

During the Spanish regime the most antiquated type of animal-driven mills were the rule, until the latter part of the nineteenth century, when animals were replaced by steam power furnished by small slide-valve engines. Juice resulting from the very low extraction of these small mills was boiled in trains of open kettles set directly over fire. The result was a low grade of muscovado sugar, more or less discolored from caramelization of portions which burned on the sides of the kettles. But by this time the world had learned to appreciate pure sugar of light color and free from bitter caramel, consequently the trade was no longer content with the open-kettle product of ancient times. Most sugar countries had long since discarded old open-kettle factories and replaced them by others capable of turning out a high grade of centrifugal sugar, boiled under reduced pressure, free from caramel and other impurities.

In 1885, Spaniards engaged in the sugar industry of the Philippines endeavored to improve the products of their mills by replacing open-train evaporators by small vacuum pans. After a few unsuccessful trials with these modified factories, they abandoned the attempt at making centrifugal sugar, and it was not until the Americans came into possession of the Islands that another attempt at modernization was made.

In 1910 the sugar industry was introduced on the Island of Mindoro, when one of the most modern sugar factories was started near the Town of San Jose. The success of this enterprise caused others to install centrifugal factories, and to-day eighteen modern mills operate in various districts, as follows:

Sugar Factories in the Philippines.

Name of Factory.	Capacity Tons Cane Per Day.	Where Located.
Calamba Sugar Estate	1,800	Canlubang, Laguna
Mindoro Sugar Co	1,000	San Jose, Mindoro
San Carlos Milling Co	800	San Carlos, Negros Occidental
North Negros Sugar Co	600	Manapla, Neg. Oc.
Bearing Central	500	Cabancalan, Neg. Oc.
Philippine Sugar Development Co	300	Calamba, Laguna
De La Rama Sugar Central	300	Bago, Neg. Oc.
Guanco Central	300	Hinigaran, Neg. Oc.
San Isidro Central	250	Cabancalan, Neg. Oc.
Carmen Central	200	Calatagan, Batangas
Palma Central	200	Ilog, Neg. Oc.
San Antonio Central	150	La Carlota, Neg. Oc.
Dinalupihan Factory	125	Dinalupihan, Bataan
Talisay Central	125	Talisay, Neg. Oc.
Canlaon Factory	125	Canlaon, Neg. Oc.
Muntinlupa Factory	100	Muntinlupa, Rizal
Saint Louis Oriental Factory	90	Manaoag, Pangasinan
Look Factory	90	Nasugbu, Batangas

Factories Under Construction.

Hawaiian-Philippine Co.	Silay, Negros Occidental
Pampanga Sugar Central	Floridablanca, Pam.
Maao Sugar Central	Maao, Neg. Oc.
Bais Sugar Central	Bais, Neg. Oriental
La Carlota Sugar Central	La Carlota, Neg. Oc.
Talisay-Silay Sugar Central	Talisay, Neg. Oc.
Bacolod-Murcia Sugar Central	Bacolod, Neg. Oc.
Isabela Sugar Central	Isabela, Neg. Oc.

It is estimated that at least eight times as many factories will eventually be required for manufacture of the crop when the farm lands of the Islands, so well adapted to the production of sugar, are developed, and when modern systems of cane culture are more generally employed.

Climatic conditions in the Philippine Islands are particularly favorable for the production of cane. Lying, as does this region, within the torrid belt, warm weather prevails during the entire year, while in the harvest season it is both dry and hot. With reference to rainfall, there are two distinct seasons; the dry season extends from November until June, and the rainy season the remainder of the year. During the former, in normal years, occasional showers occur, sufficient to give young plants and ratoon cane a start; but these are not of sufficient importance to interrupt milling and cause reduced purities of the cane juice, except in abnormal times, such as in 1915. This favorable condition during the maturing season is largely responsible for the remarkably high percentage of sucrose in the cane and the high co-efficient of purity of the juice obtaining in the Philippines.

The approach of the rainy season is evidenced by greater regularity of showers. These usually fall in the afternoon or at night and increase in intensity until July, when the very heavy rains begin. During the latter part of September or early part of October they gradually diminish in intensity, and by the beginning or middle of November they virtually cease.

Occasionally rains are accompanied by heavy winds. This is especially true of certain sections known as "typhoon regions." These, among other places, include the southeastern portion of Luzon and the Islands of Leyte and Samar. While these storms are not generally sufficiently violent to wreck a modern sugar central, if it is properly built and reinforced, yet it is deemed a wise precaution to construct the low type of factories in such regions. When heavy storms occur during the latter part of the growing season, they often uproot cane, or at least tangle and twist it so as to make harvesting more difficult.

The planting season necessarily coincides with that of harvesting, since cuttings from immature tops harvested for milling are used as seed. These are planted in rows approximately one and a half meters apart, so that approximately 20,000 points are required for each hectare

(2.47 acres) of land. Planting is practically finished by the middle of the rainy season; the bulk of the work of cultivation must be done. From then until harvest, care of the cane consists mainly in occasional weeding and hoeing and attention to drainage.

On modern plantations land is prepared by aid of steam and gasoline power, while on smaller ones, only man power and animals are used. Subsequently cultivation is done by animal power, and harvesting by hand, the workmen preferring the characteristic native "bolo" for cutting. The cane is transported to the mills on sleds, animal-drawn carts, steam or gasoline driven wagons or steam railways, according to the stage of development of the plantation.

The soil of the various sugar districts varies, but the major part is of volcanic origin. In most places it is exceptionally rich in potash, especially in those vast regions near the extinct volcanoes of Canlaon in Negros, Mayon, Ambos Camarines and Arayat, Pampanga.

These lands are generally well supplied with phosphorus and lime for plant needs, but are usually deficient in nitrogen. Still, numerous leguminous plants grow in abundance, which may be used to supply nitrogen very cheaply. Lands far removed from the principal volcanic regions and those of the broad coastal plains are less abundantly supplied with potash, but at the same time sufficient of that element is present in available form to produce ordinary crops, while on the alluvial plains which have constantly supported a dense vegetation there are larger supplies. Nevertheless, the writer's research work on various sugar plantation soils throughout the Archipelago and his experiments at the Government experiment stations have indicated that applications of fertilizers containing the proper amount of various plant food elements to make a "balanced ration" of these in an available form would increase yields remarkably.

The soils vary greatly in texture. Some regions have heavy retentive soils, which are very difficult to cultivate, except when the moisture content is just right. When too much water is present they cake and become very hard, while if they are too dry, they break up into big clods. These soils are quite often well supplied with plant food material, because filtration of soil waters containing dissolved plant food material is retarded by their firmness. Another type of soil found in various sugar districts is a light sandy loam. Cane does extremely well in this, but fertilizers are often required for production of large crops. These soils are easily handled and are ordinarily preferred by experienced planters.

The yield of sugar in the Philippine Islands is far below that which will be attained when the industry is carried on along more modern lines. Many lands now cultivated to cane have been planted to this crop year after year for half a century or more, with little attempt at

proper drainage, use of fertilizers, irrigation, deep plowing and subsoiling, or even rotation with crops, adding humus and nitrogen to the soil. In fact, it is a general custom to burn off all plant material before plowing in order to facilitate this work.

The lands have continued in a fair state of productivity, considering the treatment they have received. The average yield to-day in the principal sugar districts is slightly less than 40 tons of cane, or approximately four tons of finished sugar per hectare. The writer has proved at the experiment stations and plantations that this may be increased three-fold by modern methods.

The coasts of the Islands on which sugar is produced are indented, and while some favorable landing places are found, most of these are suitable only for medium-sized vessels, due to shallow waters which extend out a great distance. In the old days "lorchas," or sailboats of less than 100 tons capacity, were used to transport sugar to the market center, Iloilo, for the Islands of Negros and Panay, but where modern central factories have replaced old mills, lorchas have given way to barges and small steamers, and in some places, where the distance from land to deep water is not too great, long wharves have been constructed. This has been done at San Carlos, on the east coast of Negros, and at Pulupandan, on the west coast.

While sugar cane may be grown, and in fact is grown to some extent in all of the provinces of the Philippines, yet its cultivation on a commercial scale is limited to those which have extensive level lands and rich soils. Distribution by provinces in 1919 was as follows:

Provinces.	Hectares.	Provinces.	Hectares.
Negros Occidental	55,712	Ilocos Sur	5,559
Pampanga	34,458	Cebu	5,351
Batangas	24,138	Oriental Negros	2,996
Iloilo	15,553	Bulacan	5,004
Tarlac	8,846	Antique	4,540
Laguna	6,801	Mindoro	1,759

Four kinds of sugar are manufactured on a commercial scale, namely, refined, centrifugal test, bayong muscovado and pilon muscovado. Only one factory, the Luzon Sugar Refinery, makes high-grade refined sugar. This factory, which is at Malabon, in Rizal Province, about seven miles north of Manila, has a maximum capacity of twenty-five tons of centrifugal sugar per day. Animal bone char has been used exclusively as the clarifying medium, but other forms of charred carbon will be substituted, if plans of the past year materialize The three grades of crude sugar, centrifugal test, bayong and pilon, are used as the crude product in this factory. In case lower grades of muscovados and centrifugals are employed, melting and preliminary subsidation, and later, filtration through canvas bags are required before the sugary solution is passed through char-filters; but where better grades of centrifugal test sugars are used, the crystals are dis-

solved and passed through char-filters in a manner identical to that employed in American and European refineries.

Three things operate against the success of the refining industry in the Philippines, namely, the high cost of fuel necessary in evaporation and recrystallization and drying, the limited local market for refined sugar and the long journey to American markets, which often results in the product becoming damp and deteriorating in quality. These adverse conditions are offset by the plentiful supply of raw material available at a reasonable price, as well as by the abundance of cheap labor.

Centrifugal test sugar is made at centrals on large modern plantations for remelting in refineries as a source of standard granulated and cube sugar. In the manufacture of this sugar, the cane is passed through massive rolls which extract as high as 98 per cent. of the sucrose therefrom. The juice is then weighed, tempered or neutralized with lime, passed through a heater and settled, after which the clear supernatant liquor is passed to a large apparatus, termed "effects," where evaporation takes place under reduced pressure. In this the juice is reduced to the syrup stage, in which it still contains approximately 50 per cent. of water. It is then passed to sugar boilers, where evaporation is continued until the solution becomes so concentrated that the sucrose is forced out of solution by crystallization. This heavy solution, termed "massecuite," is then spun in centrifugals, which causes the molasses to be separated from the crystals and increases the purity of the latter. This sugar is then washed in centrifugals until the desired polarization or percentage of sucrose is reached.

By far the greater percentage of sugar manufactured in the Philippines in the past has been "bayong," or "mat" sugar. This is a type of open-kettle muscovado, made by the methods used in other sugar countries a century ago. The cane is crushed and the juice extracted by means of small, poorly-equipped mills. It is then tempered with a very crude grade of lime, and boiled in open kettles over a direct flame until reduced of its moisture content to a point where it can be handled in bags made from buri palm leaves. This sugar is graded from 1 to 5, according to the Government standards, as follows:

No. 1—A sugar polarizing 87 or above
No. 2—A sugar polarizing 85 to 86.9
No. 3—A sugar polarizing 82 to 84.9
No. 4—A sugar polarizing 80 to 81.9
No. 5—A sugar polarizing 76 to 79.9

Lower than No. 5 is classed as "corriente," or current.

Better grades of mat sugar are sold to the United States, Europe, Hong Kong and Japan and melted in refineries for use in making high-

grade refined sugar. The lower grades are shipped to China, or used by the poorer classes, while corriente is often made into alcohol.

In general, it may be said that the sugar industry of the Philippine Islands offers exceptional opportunities for investors. The fertile areas which have not been cultivated, owing to lack of sufficient capital, are almost unlimited, and the regions now exploited in sugar production are, from our modern viewpoint, comparatively undeveloped.

MINERAL AND FORESTRY RESOURCES.

THE PHILIPPINE MINING INDUSTRY.

By Frank B. Ingersoll,
President, Philippine Exploration Company.

Chinese writings of as long ago as the third century report gold as the chief product of Luzon, Island of the Philippine Archipelago.

Activity in mining received a severe setback by the prohibition imposed by the Spanish government in 1894. It was shortly prior to this time that European capital (mostly British) began to make mining investments in the Philippine Islands. These were confined almost entirely to Camarines Norte. One British concern planned operations on a large scale. Several quartz properties were opened up and considerable expensive machinery imported from England. Just when the project was getting fairly under way the Philippine insurrection of 1896 broke out. The English engineers in charge fled for their lives and the machinery and mine workings alike fell into disuse and decay. However, some of the machinery parts are still in evidence and have recently been made use of in operations.

From the outbreak of the insurrection until the establishment of civil government by the United States in the Islands in 1901 mining languished. Nevertheless during the latter part of this period venturesome spirits—mostly ex-soldiers of the American army of occupation—were busily prospecting. Although they made efforts to stake and record claims by proceedings patterned after the practice in the United States, there was no legal recognition of such steps until after the passage of the Philippine Bill (the Act of Congress of July 1, 1902), which put a new Mining Code into effect.

From that point there has been a steady growth in the mining industry, notwithstanding that there has been a scarcity of capital, a lack of transportation facilities, of reliable labor and of competent superintendence, and insufficient and to some extent unfriendly laws, together with a want of appreciation both by the Government and by the people of the importance of the industry.

Although prospecting and development were actively going on during the first few years of American occupation, the gold output did not reach appreciable figures until 1907 when it amounted to ₱187,647. Thereafter there was a steady advance in production until it reached ₱3,011,755 in 1916.

In 1917 it fell down to ₱2,816,638 while for 1918 it will probably be still slightly less.

The recent falling off in the output is largely due to war conditions which prevented continuous operation from lack of proper materials and supplies. Added to this there has been a decided letdown in the production from dredging. This has been confined entirely to one field—Paracale—where the alluvial deposits are being exhausted. Although attractive fields have been proven by testing in other districts, war costs have put a prohibition on any new installations.

Recent gold mining is limited to three districts—Masbate, Benguet and Paracale. In Benguet there is but a single quartz mill operating, while Masbate (Aroroy) has two. At Paracale five dredges are at work.

The future of gold mining presents some difficulties, at least until operation costs have been cut down to something like normal. Conditions which increase the cost of operation often serve to change a paying mine into a losing one. This is well illustrated by the effects of the recent great war. The outlay for materials, supplies, labor and in fact for everything which enters into operation costs has been met by increasing the selling price of the product. As the selling price of gold always remains fixed, no remedy is open to the miner. His business, which pays under ordinary conditions, is now changed into a losing venture.

It is not in the Philippines alone that gold mining has suffered in consequence of the war. The effects have been world-wide. In the United States many properties, operating on such a large scale that the total of profits was tremendous, have suspended operations, awaiting normal conditions. There is a great deal of discussion over the remedy to be applied and numerous suggestions have been put forward by operators and legislators. Without reviewing these here it is apparent that the Federal Government as well as those of the different mining states are determined not to permit a decline of this important industry. Suitable legislation and liberal treatment by administrative officials seems to be the program on every hand.

Here in the Philippine Islands, there has in times past been considerable to complain of on the part of mining operators as to their treatment by the Government. Without rehearsing unpleasant history it may fairly be summarized by stating that this status arose out of over zealousness on the part of certain administrative officials who

did not seem to realize the importance—from the Government's standpoint—of developing young industries.

The present Government attitude, both legislative and administrative, has all the earmarks of being liberal—a constructive policy aimed toward building up all lines of industry and particularly those which tend to the development of the natural resources of the country.

With a reasonable period of waiting to permit economic conditions to adjust themselves there seems no good reason why the gold production should not shortly resume its upward march. Undoubtedly the gold deposits of the Islands are widespread. Hardly a stream from whose sands some showing of gold cannot be panned. Only insignificant percentage of the mineral ore has as yet been properly prospected. While there are failures to record in mining operations there are other instances which demonstrate that mining can be carried on profitably.

To summarize briefly what seems to be needed is more capital, with which, properly utilized, to do more thorough prospecting and preliminary development, to install more modern and effective equipment, to tide over temporary backsets, to procure more efficient management and superintendence.

Of the considerable number of mining engineers of prominence who have visited the Islands not one has condemned them but all have insisted on the great necessity of the measures above noted.

This article has been limited to gold mining for the reason that there has been almost no mining development in other branches. However, there are indications of valuable mineral deposits of various kinds throughout the Archipelago.

There are strong showings of petroleum in Tayabas, Cebu and Mindanao.

The indications are that it would pay to develop many of these deposits and the present era of prosperity and development should within the next few years witness a considerable production in several branches of the industry outside of gold mining.

PHILIPPINE OIL FIELDS.

By James J. Rafferty,

Trade Commissioner of the Philippines in the United States.

The existence of petroleum on Bondoc Peninsula is established by the presence of seeps of petroleum associated with inflammable gas at various places throughout the oil field.

All the petroleum encountered so far is similar in character and of a good quality. It is of low specific gravity and contains a large proportion of light oils which would make it of relatively high value as a commercial petroleum.

The seeps are in highly inclined strata which are probably in all cases part of the structure of anticlinal folds. From this association it is believed that the petroleum in this field has, in accordance with the general law of petroleum accumulation, tended to collect in the crests of anticlines.

The petroleum occurs, associated with certain horizons, in an extensive series of beds of sandstone and shale (Vigo shale) which is similar in character to the oil-bearing rocks of productive fields, notable those of Japan. The principal seeps are found in the upper part of this series in a zone designated as the Bacau stage, which is predominantly shale but which contains subordinate beds of sandstone. In its seepage, the petroleum is associated with the shale rather than the sandstone and may be observed in some cases to come directly from the shale. Beneath the surface, where closed lenses of sandstone probably exist, the principal accumulation of petroleum would be expected in the more open, sandy zones. At the surface the light oil appears to have escaped readily from the coarse-grained beds and to have been retained only in the fine-grained shale.

The petroleum may have originated, in part at least, in the Bacau stage of the Vigo shale where it is now found. Globigerina and other organic remains are found in the strata with which the oil is associated, the decomposition of which may have given rise to petroleum. There is a possibility, however, that the oil is not indigenous to the strata in which it now occurs but has migrated from its source to another horizon. Beds which are concealed so that they cannot be examined at the surface and which, consequently, may be the source of the oil which is now associated with the Bacau stage of the Vigo shale, occur at the Bondoc Peninsula.

Appreciating the importance of the thorough exploration and development of the oil fields, the Philippine Legislature passed the following measure March, 1919:

"AN ACT TO CREATE THE NATIONAL PETROLEUM COMPANY."

Be it enacted by the Senate and House of Representatives of the Philippines in Legislature assembled and by the authority of the same:

Section 1—A company is hereby organized, which shall be known as the National Petroleum Company, the principal office of which shall be in the city of Manila, and which shall exist for a period of fifty years, from and after the date of the approval of this Act.

Section 2—The said corporation shall be subject to the provisions of the Corporation Law in so far as they are not inconsistent with the provisions of this Act, and shall have the general powers mentioned

in said Law and such other powers as may be necessary to enable it to drill wells for the development of petroleum deposits, and to work said deposits and sell the output thereof.

Section 3—The capital of said corporation shall be five hundred thousand pesos, divided into five thousand shares of stock having a par value of one hundred pesos each, and no stock shall be issued at less than par nor except for cash.

Section 4—The Governor-General, on behalf of the Government of the Philippine Islands, shall subscribe for not less than fifty-one per cent. of said capital stock, and the remainder may be offered to the provincial and municipal governments or to the public at a price not below par, which the board of directors shall from time to time determine. Ten per centum of the value of all stock subscribed shall be paid at the time of the subscription, and the balance thereof shall be paid at such time as shall be prescribed by the board of directors. The voting power of all such stock owned by the Government of the Philippine Islands shall be vested exclusively in a committee consisting of the Governor-General and the presiding officers of both Houses of the Legislature.

Section 5—The board of directors of the company shall consist of five members.

Section 6—There is hereby appropriated, out of any funds in the Insular Treasury not otherwise appropriated, such sum as may be necessary for the payment of the stock of the National Petroleum Company to be acquired by the Government of the Philippine Islands; Provided, however, That the Insular Auditor shall not set up any sum or sums on his books until necessary to make the payment or payments authorized by this Act; And, provided further, That unless otherwise provided by the Philippine Legislature, the sum available for investment during the year nineteen hundred and nineteen shall not exceed fifty thousand pesos, and a like sum shall be the maximum available for such investment during each subsequent year.

Section 7—This Act shall take effect on its approval.

Approved, March 4, 1919.

To date the work of the National Petroleum Company has been of an exploratory nature but it is anticipated that the coming year will show many interesting developments.

A recent investigation of the petroleum industry, made by the Government, discloses the fact that a number of oil companies have been incorporated in the Philippines but failed to operate their projects. The following are the substantiated reasons for this condition:

1. The majority of the companies did not have sufficient capital to adequately provide themselves with the necessary equipment and men.

2. Incorporators were timid about putting their money into the development work.

3. The necessity of competent technical men was not fully realized

LUMBERING INDUSTRY IN THE PHILIPPINES.

By Helene H. Wilson,

Publicity Secretary, Philippine Government Commercial Agencies.

Practically one-third of the total area of the Philippine Islands is virgin forest land, or approximately 40,000 square miles, with stands of from 15,000 to 35,000 board feet to the acre. Even stands of from 45,000 to 65,000 board feet to the acre are not uncommon at elevations of from one thousand to eighteen hundred feet above sea level. In addition to the foregoing there are close to 20,000 square miles of more or less scattering, cut-over and second growth forests, which are classed by the Bureau of Forestry as "Non-Commercial." In this area the stand does not average more than between two and three thousand board feet to the acre. It is from this second classification that much of the present supply of timber and firewood for local use is taken.

The commercial forests are located on the islands of Luzon, Mindoro, Samar, Leyte, Negros, Mindanao, Palawan and a number of the smaller islands. In fact, they predominate in all the principal islands except Bohol and Cebu.

The composition of the forests from the botanist's point of view is very complex, but to the forester and the lumberman it is quite simple. About three-fourths of the total volume of the virgin forest is composed principally of trees of the dipterocarp, of lauan family, which furnish all the abundant export timbers of the islands. Taking the forests as a whole, practically 90 per cent. of the standing timber belongs to a group of different botanical species that enter the market under about half a dozen trade names.

Development of the Industry.

Tales of early Chinese adventure devote considerable space to the Philippines, their people, and records of trade in these by-gone centuries between the two countries—long before Magellan led the Spanish Armada on their conquest of the Far East. It is to these we must refer for our earliest records of the lumber industry in the Philippine Islands. We find that even in those days the Chinese merchants ob-

tained logs of fancy cabinet woods and ship timbers from the Philippine forests and exported them to China for manufacturing purposes.

The Spanish brought with them some ideas for the improvement of the lumbering industry, and we find that in the latter part of the fifteenth century a few small water, and later on steam power, mills were built. They followed to a great extent the old system of buying logs and sawing them only to order. Between ten and twenty years before American occupation three steam power mills larger than any theretofore attempted were erected at Manila.

The Americans found the methods of lumbering to be primitive. The handling of the industry on a large scale was practically unknown. Individual trees were selected, felled, stripped of bark and sapwood, or else squared and the resulting poles or logs hauled out with teams of carabao (water buffalo). The hauling was done on crude carts or timber wheels, sledges, or by dragging the log over the ground with no more apparatus than an occasional skid or roller. Few improvements have been made even to-day by the small operators.

The development of the industry during the past twenty years is a glowing record of achievement, in the face of almost unsurmountable difficulties. The first years were a series of heartbreaking experiences due in a large measure to the distance from the United States as a source of supplies; inadequate transportation of out-of-the-way places, and chaotic local market conditions. But having conquered all these manifold difficulties, the industry as it exists at present has gained a foremost place among typical American achievements in the Far East.

The lumbering industry, ranking among the leading industries of the Islands to-day, has brought many blessings to the people other than attaining its own present importance. In Mindanao it has proved to be of genuine educational value. It has given to the local population permanent employment and the means for securing a continuous and better food supply.

Logging engines, railroads and other modern equipment have been introduced in the last fifteen years, and are now in use by all the large operators. Generally speaking, the managers, boss loggers, superintendents of logging railways, sawyers, saw-filers and yard bosses are Americans. The fellers, locomotive and stationary engineers, track layers, skidders, loaders, setters, operators of edgers, trimmers, resaws, planers and matchers are Filipinos and Chinese. Special attention is given to training for the more technical work of the lumbering industry in the Trade School, conducted under the direction of the Bureau of Education at Manila.

Accessibility and Transportation.

The timber lands are often rough, but no more so, and generally less so, than in the greatest lumber regions of North America. There are but few large water courses, but no point anywhere, even in the largest islands, is more than 50 or 75 miles from tidewater, and the topography is rarely such as to present inseparable obstacles to the construction of railways. Most of the larger mills now in operation are actually on the seacoast and have larger logging railroad extending inland to distances of ten miles or more. There are a number of regions where there are excellent opportunities for erecting new mills, either in the timber itself or at points on the coast or waterways leading to the sea.

Steamers specially fitted for carrying lumber are few, and freight rates correspondingly high. Large operators should arrange for their own transportation from their mill to Manila or other points within the Islands where the lumber is intended for home consumption. In the case of export stock, shipments should be made direct from the mill in ocean-going steamers to prevent the additional expense of transshipping at Manila.

Cost of Operations.

The cost of operations is less than in the forest regions of the Temperate Zone or other forest regions of the Tropics. Ninety-nine per cent. of the timber is the property of the Government and is administered by the Bureau of Forestry under a system of licenses granted for from one to twenty years duration, with the privilege of renewal. The long-term license arrangement (or concessions, as they are popularly called), are only granted on certain conditions which specify the amount of capital to be invested, the minimum cut during several suceeding years, together with certain requirements a sto logging and manufacturing, equipment, etc. Stumpage is paid for as cut at the following rates, based on the classifications set forth below:

Classification of Forests.

Group I (Names of Trees)—Acle, Baticulin, Betis, Camagon, Ebony, Ipil, Lanete, Mancono, Molave, Narra, Tindalo, Yacal.

Group II (Names of Trees)—Alupag, Aranga, Banaba, Bansalaguin, Banuyo, Batitinada, Bolongeta, Calamansanay, Calantas, Dungon, Guijo, Macaasim, Malacadios, Mangachapuy, Palo maria, Supa, Teak, Tucang-Calao.

Group III (Names of Trees)—Agoho, Amuguis, Anubing, Apitong, Batino, Bitanhol, Catmon, Calumpit, Cupang, Dalinsi, Dota,

Dungonlate, Malacmalac, Malapapaya, Malasantol, Mayapis, Palosapis, Panao, Sacat, Santol, Tamayuan, Tanguile.

All other groups are placed in four.

The metric system of measurement has been officially adopted by the Philippine Government. The forest charges based on the volume of round timber of the different groups are as follows:

Charge Per One Thousand Board Feet.

Group I	$5 00
Group II	3 00
Group III	2 00
Group IV	1 00

Inasmuch as the bulk of the cut of lumber at the sawmills (about 90 per cent.) is of the third and fourth groups, stumpage is comparatively cheap. A big advantage to the Philippine lumberman is that as the stumpage is not paid for until cut the necessity for a big investment in timber holdings before manufacturing can proceed is obtained. Long-term agreements usually cover an area of from 10 to 300 square miles; skirting tidewater on at least one side.

Logging and sawmill machinery comes in free of duty, if imported from the United States. From other countries the import duty is 15 per cent.

Labor Supply.

That the Philippine labor problem can be successfully solved is an established fact so far as the lumbering industry is concerned. When properly treated the Filipinos are conscientious and fairly steady workmen.

In sparsely settled forest regions it is necessary to import laborers from the more thickly settled districts. The majority of these men are married and when they make a move that gives evidence of permanent betterment they expect to bring their families with them. Therefore, colonies must be established, schools and churches built, and amusements provided. Once the lumberman gains the confidence of his employes, he will find long lists of applicants awaiting him.

Classes of Mills.

There are three distinct classes of lumbering plants in the Islands:

(1) Hand-sawing, also known as whip-sawing, used extensively in the provinces by the Chinese lumbermen. Practically every town has its whip-sawyers. There are also several larger hand-sawing mills located in Manila, Cebu, Iloilo and other of the principal cities. These mills have a capacity of from 3,000 to 10,000 board feet per day.

(2) The small water or steam mills, working along much the same

lines; but carrying a stock of thousands and even of tens of thousands of feet of rough and milled lumber. These mills are run by Filipinos, Chinese and Spaniards, with a sprinkling of American and European operatives in the larger mills.

(3) The large steam mills, both band and circular saw types, established almost entirely by American and European capital, and managed by Americans. These mills carry a large stock of finished lumber and are for the most part the lumber exporters of the Islands.

Sawmill waste almost always provides ample fuel. Logging locomotives burn principally wood, with a small admixture of coal. Until recently the major portion of the coal used in the Philippines has been imported, but with the organization of the National Coal Co., for the development of the Philippine coal fields, it is believed that a sufficient supply for all home uses will be obtained, thereby lowering the price of this fuel considerably.

Uniform Grading Rules.

Efforts have been made for years past to establish some standard system of grading Philippine lumbers. In 1917, the Bureau of Forestry secured the services of an expert hardwood lumber inspector, who was familiar with Philippine lumber, and detailed him to draw up a set of grading rules suitable to the local species. The lumber, both for export and home consumption, is now being graded in accordance with these standard rules, specifying firsts, seconds and export common. Guaranteed grades will also apply to railroad ties, car material and construction timbers.

In addition to the Trade School, where boys are taught the technical side of lumber production, a School of Forestry is maintained under the supervision of the Director of Forestry, where students are prepared to take place in the Forestry Division of the Government service.

About $6,000,000 is invested in the more modern sawmill equipment in the Philippines, and several millions more, of which no accurate data is available, are invested particularly in animals, by the thousands of small licensees in their logging operations.

Production and Prices.

In spite of the large decrease in exports, owing to the demand on shipping for other products and the heavy freight rates, almost all of the mills continued to operate full time during 1917, 1918 and 1919, and in several cases overtime. Taking the seven larger mills, they produced 62,000,000 board feet in 1918 as against 36,000,000 board feet in 1917. The total production for mill-sawn timber in 1918 was 75,000,000 board feet, as compared with 60,000,000 board feet in 1917.

These figures are only for mills operating on their own license areas and do not include the output of the mills operating in various portions of the Islands, which buy their logs from logging licensees.

In addition to the native lumber manufactured in 1918, there were imported 6,308,700 board feet, practically all from the United States; of which a portion was re-exported to India and the Dutch East Indies. The figures showing the 1919 production and distribution have not yet been compiled.

One of the most difficult phases of a discussion concerning timber is to give a just estimate of prices. The price of a given wood, even where lumber is of the same dimensions and quality, may vary in accord with certain external conditions. Broadly speaking, supply and demand are the chief governing factors in the long run.

With the present era of prosperity in the Philippines, the local demand will undoubtedly increase greatly. The increased activity in other industries, particularly copra, and the establishment of cocoanut oil factories, has ushered in a new and better day for the many small land owners and they are showing a keen interest in the building of wooden dwellings to replace those of mixed materials now common in the provinces.

Public works projected for the coming year are more extensive than any ever before contemplated in the Island and the demand for this purpose alone should be well over 15,000,000 board feet.

Varieties of Woods.

The Philippine forest products range from the lightest daluro (air roots of pagatpat), used as a cord substitute, to one of the heaviest woods in the world—mancono (80 pounds to the cubic foot) and from pines similar to the yellow pines of our Southern States to the finest cabinet woods.

OPPORTUNITIES FOR INDUSTRIAL DEVELOPMENT.

The following resumé of industrial resources awaiting development was originally prepared by the Philippine Bureau of Science under the direction of Dr. Alvin J. Cox.

Fisheries.

Fish Ponds—The value of the fish ponds in the vicinity of Manila is about 6,000,000 pesos. There are also extensive ponds in various other localities in the Islands. These ponds in many cases serve a two-fold purpose—the growing of the ordinary market fish, bañgos, and the manufacturing of salt—each being a profitable industry.

Food and Game Fishes—Next to agricultural products, food fishes are of the greatest importance to the Filipino people. In Manila alone fresh fish to the value of over 5,000 pesos are sold each day. Sixteen hundred species of fishes from Philippine waters have been identified, and with a few exceptions they are all used as food. Such fishes as the anchovy, sardine, and herring abound and constitute a potential source of wealth.

Game fishes abound in many places in the Islands; the jew fish, the bonita, the sword fish, and tuna afford the best sport.

Pearl Fisheries—Pearl shell to the amount of 292,211 kilograms, valued at 354,260 pesos, was exported during 1913, the number of pearls secured during the year was above the average, and the price paid by dealers was high. Fifty-two pearling boats are now operating in Moro Province. The pearl fisheries are proving to be a very attractive field of investment, especially for Japanese capital.

Button Shells—The increasing demand for shells for the manufacturing of pearl buttons, particularly for the top shell (*Trochus*) and the turban shell (*Turbo*), has stimulated the gathering of them by fishermen. The amount of these shells exported during the last year was 738,025 kilograms, valued at 287,120 pesos.

Window Shell—About 5,000,000 window shells are used each year in the building operations in the city of Manila, a large proportion of which come from the beds in Manila Bay. The demand for these shells in other countries for making windows, lamp shades and screens is steadily growing. The Bureau of Science is making an effort to increase their cultivation.

Preserving Fishery Products—The waters of the Philippines team with sardines and anchovies of good quality, and yet sardines to the value of about 100,000 pesos are imported into the Philippines each year. However, an interest is being taken in this matter by American packers who have requested samples of sardines and have indicated their willingness to invest money in a fish cannery. A sardine cannery should pay good dividends.

The drying and curing of fish could be more profitably and extensively carried on by adopting modern methods. Preservation of commercial fish and fishery products in the tropics.

Starch.

An investigation of a number of starch-producing plants growing in the Philippine Islands has been carried on. Among these may be mentioned tapioca or cassava (*Manihot utilissima* Pohl), the native name being camoting cahoy; arrowroot (*Maranta arundinacea* Linn.);

sincamas (*Pachyrhizus erosus* Urban); the Polynesian arrowroot (*Tacca pinnatifida* Forst.); yams (*Dioscorea; Amorphophallus campanulatus* Blume); seeds of *Cycas circinalis* Linn.; and the sugar palm (*Arenga saccharifera* Labill.). The most promising of all these is the cassava which grows luxuriantly in various parts of the Islands and produces large quantities of starch. Twenty-seven per cent. of the weight of the material can be extracted by commercial processes. The starch of the sugar palm is used by natives of certain parts of the Islands, principally the Mañgyans, a hill tribe of Mindoro. They extract the starch from this palm and use it as a staple article of diet. They transport it to the lowlands in baskets of palm leaves where it is sold and traded for other articles. In Mindanao the sago palm (*Metroxylon rumphii* Mart.) is of great local importance, and the commercial exploitation of the Philippine sago is a possible further development. This is the species that yields the sago of commerce, and it occurs abundantly in parts of Mindanao.

Vegetable Oils.

Important vegetable oils of the Philippine Islands, other than coconut oil, are produced from lumbang, kapok, cashew, castor bean, cotton seed, physic nut, and pili. This type of oils is also derived from oil-bearing seeds and is of considerable importance. Lumbang oil has good drying qualities and is used in the varnish trade. The production of this and of pili nut oil is increasing in importance. Other oils now little known may prove of commercial value.

The Perfume Industry, Essential Oils and Terpenes—The Philippine Islands are especially rich in plants which produce large numbers of terpenes. The most important essential oil and terpene-producing plants have been studied by the chemists of the Bureau of Science and their commercial value discussed in The Philippine Journal of Science. A comprehensive investigation of the Benguet pine has shown that excellent turpentine and colophony, practically identical with the products originating in America, can be produced from this source. Various resins, such as elemi, balao, apitong and copal have been investigated to determine their chemical composition, their value in the manufacture of varnishes, etc. The essential oils responsible for the fragrance of many plants and flowers have also received considerable attention; among these are ylang-ylang, champaca, orange, lemongrass, vetiver, cinnamon and ginger. Several of these are used in the perfume industry and others in the manufacture of nonalcoholic beverages and fruit flavors. This work should be the basis for industries in the Philippine Islands.

LIMESTONE AND SILICATE INDUSTRIES.

Sand, limestone and clay, although the most common, familiar and perhaps the least appreciated of mineral resources, nevertheless constitute an asset of importance to any country. Limestones of excellent quality are abundant and of widespread occurrence throughout the Philippine Islands, and in certain localities there is also an abundance of sand, shale or clay, the physical and chemical properties of which guarantee to this Archipelago stable industries among which the manufacture of Portland cement, quicklime, hydraulic lime, sand-lime brick and artificial stone products; building, vitrified and fire brick; glass, roofing material and vitrified pipes, tiles and other ceramic products are certain to become exceedingly important.

Portland Cement—The imports of Portland cement during the past few years have had an average annual market value of about 1,500,000 pesos, and the local consumption is certain to increase as the country progresses in financial and industrial importance. The local manufacture of this material will not only save transoceanic freights, but also an import duty of 3.20 pesos per ton on all non-American cements. The Rizal Cement Company is constructing a 1,000-barrel per day plant at Binangonan. Excellent Portland cement has been made from several local deposits of limestone and siliceous materials. In Cebu desirable cement raw materials occur adjacent to undeveloped coal fields, the fuel from which is of suitable quality for burning cement.

Sand-Lime Products—Conditions are very favorable in the Philippines for the commercial manufacture of brick building blocks, tiles, slabs, marbles and ornamental stones from sand and lime. The cost of manufacturing and selling 9-inch bricks of the best quality is estimated not to exceed 13 pesos per 1,000, which, in comparison with the price of other building materials, offers considerable margin for profits.

Lime—Pure coralline and crystalline limestones suitable for the manufacture of lime occur throughout the Philippine Islands. The value of the lime now produced is about 100,000 pesos per annum. It does not meet the demand in either quantity or quality. A well-burned lime, such as is produced in the experimental kiln at the Bureau of Science, has a market value of 50 pesos per ton. If good lime were available at a moderate price, there is little doubt that the demand for it would soon equal the output of large kilns. The increasing production of sugar by modern methods is augmenting the demand for lime. It is probable that the industry would thrive best if conducted in connection with a sugar central or with a sand-lime-brick plant.

Philippine Dyes—While it is true that the artificial dyes have largely supplanted natural materials, in some districts there occur

natural dyes of sufficient brilliancy, permanency and quantity to be very valuable. They are employed in the dyeing of native fibers for the manufacture of hats, mats, baskets, cloth, etc. A number of these dyes have been investigated and the results published.

Tanning Materials—Tanners of the United States are becoming each year more dependent upon imported material. Bark from the better species of Philippine mangrove trees contains 30 per cent. of tannin, and a net profit of from 50 pesos to 60 pesos per ton can probably be made on tanning material derived from the mangrove swamps in the Philippine Islands. There are areas or workable swamps in the Islands capable of producing yearly 1,500 metric tons of extract, having a value of 210,000 pesos. The exploitation of these swamps would involve a firewood and piling industry of about an equal magnitude. The extended use of mangrove bark and more particularly mangrove extract is comparatively a recent development. All the species of mangrove of any importance in the eastern tropics are found in the Philippine Islands, and the opportunity for a profitable cutch industry is very great.

Papaya Gum—A study of the properties of papaya gum made from the latex of *Carica papaya* has resulted in improving methods for preparing this important commercial product. The results already obtained show conclusively that gum may be made in the Philippines which is equal, if not superior, both regarding color and activity, to any now on the world's market. The constantly increasing demand for papaya gum as a substitute for pepsin and the well-known fact that satisfactory gum is difficult to obtain assure a steady market for a high-grade Philippine product.

Medicinal Plants—A very large number of plants are used by Filipinos in the treatment of diseases. Datura, dita, sibucao, macabuhay, bonduc, purging oils and the fish and arrow poisons have been studied. A few of these are recognized as sources of various medicines in the standard pharmacopœia. The active constituents of many medicinal plants growing in the Archipelago have been isolated and identified.

There are very few commercial species. A single medicinal plant is commercially important for export at the present time and that is the St. Ignatius bean (*Strychnos ignatii* Berg.) yielding strychnine and brucine, the species being found native only in the Philippines. The castor oil plant, croton oil plant, kamala and datura (as a source of atropine) are very little or not at all utilized although all grow very luxuriantly and are very abundant. The potential commercial medicinal plants are many, but the industry must be developed by individuals. The Bureau of Science will gladly supply data with regard to specimens submitted.

Honey—Wild honey is plentiful in all the wooded portions of the Philippines, and a considerable trade is carried on in honey and wax collected by the crudest methods. Philippine honey bees produce an excellent grade of honey. Bee culture could be carried on in connection with farming. Even at present a couple of thousand pesos' worth of honey is imported each year, indicating an ample local market for the native product. Efforts to import honey bees from the temperate zone have not been entirely successful.

Alcohol—Almost the entire insular production of alcohol—about 10,000,000 proof gallons per year—is made from the sap of the nipa palm, which grows luxuriantly in a number of places in the Philippine Islands . Although extensive nipa swamps exist in the Philippine Islands, only a few are utilized commercially. The alcohol industry has been investigated and methods for improving the process of manufacture have been described in a number of papers from the Bureau of Science. Also, it has been discovered that a more profitable manner of utilizing the sap of this palm is in the manufacture of sugar.

It has long been known that several species of palm trees secrete a sap rich in sugar and the natives of various countries have taken advantage of this fact, but no exploitation on a commercial scale has been attempted for the reason that it promised no financial returns. A thorough investigation has shown that we have in the nipa palm a source of sugar which has been proved to be very attractive from the standpoint of investment. The fresh sap has approximately the composition of that of sugar-cane sap, and the methods of collecting and preserving it during transportation to the refinery have been improved. The difficulties encountered in the establishment of the business upon a large scale have been entirely overcome through the investigation of the Bureau of Science. The production of sugar from the nipa palm is an industry new to the world and one which will be unique to the Philippine Islands; it will give a remarkable value to large areas of swamp which are otherwise almost valueles.

Materials for the Manufacture of Industrial Alcohol Abundant in the Philippines.

Nipa palm sap, discard molasses from the sugar mills (amounting annually to more than seven million gallons), also sawdust, wood waste, ripe fruit, especially bananas make excellent materials for the manufacture of industrial alcohol. These are found in abundant quantities in the Islands. The development of the industry is advocated for lighting purposes and for fuel.

Rope Industry.

There are several successful rope and cordage factories now in operation in Manila. In 1915 the rope exports amounted to ₱189,799, while in 1918 they reached the sum of ₱1,733,986.

Manila Hemp (or Abaca) is one of the leading agricultural resources of the country. It is cultivated almost entirely by small farmers, and even a relatively short period of depression would be sufficient to drive many of them out of business. The cordage market is not subject to the sharp fluctuations and control as is the hemp. The establishment of a sufficient number of rope and cordage factories for the manufacture of the greater part of the Manila Hemp into marine cable and cordage is desired.

WATER POWER AND ELECTRICAL DEVELOPMENT.

A study of the water power facilities of the Philippines, recently made under the direction of the Government, shows that the Philippine rivers offer an almost inexhaustible fountain of energy for the generation of electric power. Agus River in Lanao, Mindanao, has 350,000 H. P. available. Agos in Tayabas Province, 55,000; Angat in Bulacan Province, 9,000; and Agno in Mountain Province and Pangasinan, 60,000. Moreover, there are numerous small streams which may be developed to furnish motive power from ten to one hundred H. P. or over. Manila is well equipped with electrical power both for lighting and operation of street railways.

Electrical Development in the Provinces.

Province.	City.	Current.	Voltage.
Albay	Legaspi	Direct	220
Albay	Guinobatan	Constant	110
Albay	Ligao	.....	110
Ambos Camarines	Naga	Constant	110
Ambos Camarines	Naga	Constant	110
Batangas	Taal	Alternating	224
Bohol	Calape	.....	125
Bulacan	San Miguel	Direct	220
Bulacan	Malolos	Direct	200
Cagayan	Aparri	Direct	...
Cavite	Cavite	Alternating	220
Cebu	Cebu	.....	220
Ilocos Sur	Vigan	Direct	220
Iloilo	Iloilo	Alternating	104
Iloilo	Jaro	Alternating	104
Isabela	Ilagan	.....	110
Laguna	San Pablo	.....	224
La Union	San Fernando	.....	120
Leyte	Burauen	Direct	224
Mindoro	San Jose	.....	...
Mountain Province	Baguio	Alternating	2,300
Mountain Province	Sagada	.....	125
Occ. Negros	Silay	Direct	110

Province.	City.	Current.	Voltage.
Occ. Negros	San Carlos		250
Occ. Negros	San Carlos		125
Oriental Negros	Dumaguete	Direct	220
Oriental Negros	(Silliman Institute)	Direct	220
Oriental Negros	Bais	Direct	115
Pangasinan	Lingayen	Alternating	229
Rizal	Pasig	Furnished by Manila Electric Light and Railroad Company.	
Rizal	San Pedro Macati		
Rizal	Calaocan		
Rizal	Pasay		
Samar	Calbayog	Direct	125
Samar	Catbalogan	Direct	115
Samar	Catarman	Direct	110
Tarlac	Tarlac		250
Tayabas	Lucban	Alternating	110
Tayabas	Lucena	Direct	220
Tayabas	Tayabas	"A-6"	440 to 11,000
Zambales	Olongapo	Direct	230
Bukidnon	Diclom		300
Davao	Davao	Direct	250
Davao	Davao	Direct	115
Davao	Malita		...
Lanao	Kolambugan	Alternating	220
Sulu	Jolo		220
Zamboanga	Zamboanga		220
Zamboanga	Zamboanga		100

PAPER PULP.

For several years the Bureau of Science has been investigating the suitability of bamboo, cogon grass, abaca or hemp, and various palm fibres for paper pulp. With due regard to local conditions, the data collected show that an industry of great economic value can be developed. Careful surveys of some of the available bamboo fields have been made. Sufficient data with regard to the cost of the raw material, the quantity of bamboo available, and the cost of manufacture of the pulp are given, showing that the bamboo soda pulp can be developed into a possible export trade in direct competition with chemical wood pulp at present quotations. Other countries have already utilized the information obtained from this work, and ultimately it will be the means of starting the paper industry in the Philippines. Samples of pulp manufactured from different Philippine materials can be obtained from the Bureau of Science.

THE PHILIPPINE EMBROIDERY INDUSTRY.

By M. J. DE LA RAMA,

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The women of the Philippines have long been noted for their patience and dexterity in hand embroidery. This was one of the principal feminine industries taught in the convents by the Spanish, French and Belgian Sisters. They have wonderful designs of intricate patterns, using a great variety of stitches and also various patterns in the open work known as "Calado."

In the early days the industrial trade was established by native men, who sold their products only in the Philippine Islands. They would purchase cloth, draw a design by pencil and give it out to the women to embroider, afterwards peddling the products around the streets of Manila, selling it for the best price they could get. The designs were often crude and materials inferior, although the workmanship was excellent.

The women trained their children to continue the work of embroidery, and passing from one generation to another, the designs, the materials and workmanship all showed great improvement.

Gradually a great industry has been developed. It was difficult to secure an entrance into American markets, but after the desired styles and appropriate designs for American trade were introduced the workmanship spoke for itself and has shown an increasing prosperity with each year. The output of hand embroidery has nearly reached the mark of ₱7,000,000 a year, and the demand exceeds all present available sources of supply.

From the year ending December 31, 1914, when the total exports of hand embroidery from the Philippines totaled ₱324,912, until the end of the year 1919, when the total exportation amounted to ₱6,913,004, a period of six years, the increase was more than twenty-fold. There are to-day nineteen concerns in the City of Manila, with a personnel aggregating approximately 60,000 persons in and around the City of Manila devoting their energies to the preparation of this handiwork for foreign trade. According to a recent investigation fourteen of these concerns are devoting their efforts entirely to export business and the five others are devoting their energies to local and export business.

These concerns are not, strictly speaking, factories, but each has local headquarters in Manila, and most of them have various subagencies in Manila and the adjoining provinces. Each concern maintains from five to one hundred employees at the local headquarters and from ten to one hundred agents who deal with piece-workers in the districts of Paco, Tondo, Ermita, Malate, Santa Ana, and Singalong in the City of Manila, and the municipalities of Mariquina and Parañaque of the Province of Rizal, in the Province of Cavite, in the municipality of Taal, of the Province of Batangas, in Calumpit and Hagonoy of the Province of Bulacan and in various parts of Pampanga and Tarlac, not to mention limited districts in the Visayas.

Employees engaged at the local headquarters are for the most part working on a salary basis and are engaged in cutting, sewing, trimming, ribboning, ironing, packing and embroidering for export trade. These employees in the City of Manila do not exceed 1,700, and in addition to this the industry maintains about 350 agents or "cabecillas" who deal with the embroiderers who do piece work.

The agents distribute the material for embroidering by the piece-workers in Manila and the adjoining provinces, pay for the handiwork when finished and return the product to the headquarters at Manila preparatory to export.

Wages on the daily basis for boys engaged in ironing, packing, etc., are about ₱0.80 to ₱1.00 a day; for adults in similar work, from ₱1.50 to ₱2.00; for unskilled sewers, mostly girls who are beginning the work, a daily wage of from ₱0.80 to ₱1.00 is paid. Skilled workers among the women are paid from ₱1.50 to ₱2.50 daily. Those engaged in cutting are paid from ₱0.80 to ₱1.50 a day.

Embroidering is paid for at the rate of ₱0.75 to ₱1.00 for simple designs, ₱2.50 to ₱5.00 for a better grade of work of a more intricate character, and special designs are paid for according to agreement, in some instances as high as ₱15.00. Daily wages average from ₱1.50 to ₱2.50 per day and some receive as much as ₱3.50 a day.

Philippine hand embroideries are of cotton and linen. Practically no silks are used. The materials chiefly used in the making of Philippine hand embroideries are nainsooks, batiste, voile, georgette, crepe de chine and net cotton. All these materials are imported from the United States, and have materially increased in price since the beginning of the war. Prior to the date, nainsooks or batiste could be secured in Manila from ₱0.12 to ₱0.25 a yard, while at the present time the cost ranges from ₱0.75 to ₱1.50.

The principal articles of embroideries made in the Philippines are lingerie, children's clothes, handkerchiefs, table cloths and underwear of various classes, which for the most part are prepared according to orders received from the United States. The work done is of a very good grade and brings good prices in the United States.

Embroideries of the Philippines are exported chiefly to the United States, although a very small quantity of them are exported to the United Kingdom, Hong Kong and Australasia. The exports from 1914 up to and including the first six months of 1918 are as follows:

1914	₱324,912
1915	735,303
1916	2,328,024
1917	3,929,318
1918	4,361,352
1919	6,913,004

While the demand in the United States seems to be steadily increasing for Philippine embroideries, there are indications that the increase in exports is due to the decrease of exports of embroideries from Europe to the United States. Imports of embroideries, laces, handker-

chiefs and edgings to the United States from Europe and the Madeiras during the years 1912 to 1918, inclusive, follow:

1912	$37,094,161 00
1913	35,776,301 00
1914	33,865,822 00
1915	20,800,266 00
1916	21,153,392 00
1917	16,648,857 00
1918	10,421,083 00

The heavy increase in the exports of the Philippine hand embroideries beginning with the year 1915 and the corresponding decrease in the United States imports of embroideries from Europe and Madeiras seems to indicate that the Philippine demand is due in a measure to war conditions, but notwithstanding the resumption of the manufacture and export of embroideries and laces from Europe, Philippine hand embroideries have attained a position in the United States market which they will not lose, and on the contrary will continue to develop even faster than it can be supplied with the present available labor supply in the Islands.

Notwithstanding the trying nature on the eyes of the work of embroidering, which prevents embroidery workers from devoting long hours of daily work, the present available supply of labor nearly keeps pace with the present demand.

The field for further development is immense. The present output is only from the City of Manila and outlying territory. The rest of the Archipelago is not doing anything in this line, but there is no doubt that with the proper training the women out in the provinces could increase production by even a hundred-fold should the demand warrant it.

Hats and Hat Making—The Bureau of Science has published data on the types and grades of Philippine hats, the materials of which they are made, how the materials are prepared, where they are secured and the centers of the hat-making industry. The manufacture and exportation of hats from the Philippine Islands is a comparatively large industry.