THE

TROPICAL AGRICULTURIST

AND

MAGAZINE OF THE

CEYLON AGRICULTURAL SOCIETY.

VOL. XXVII. COLOMBO, AUGUST 15TH, 1906. **No. 2.**

Some Possibilities of Improvement in Village Agriculture. IV.

Weeding is another direction in which native agriculture appears capable of improvement. The native usually knows well enough that weeding gives a better crop, but he does not always consider the result worth the labour. If some simpler and easier method of weeding could be introduced, say by the use of a tool like the American roller-hoe, or like the "cultivator," it might be possible to encourage weeding, and thus get an increased crop in many cultivations. It is idle to tell the native to weed, or to teach him theoretically that weeding is good; he must be shown that it pays, without costing more money or labour than he can afford, or than he is willing to give.

A conspicuous feature in native agriculture throughout Southern Asia, which often offends the eye of those who have a superficial acquaintance with European agriculture, is the wild jungle-like mixture of fruit trees, bamboos, vegetables, etc., which forms the average native compound. It is highly probable that this arrangement gives many of the advantages which have elsewhere to be attained by rotation of crops, and the villager is thus able to grow his familiar foods, etc., on the same ground for an indefinite number of years. Mixture of crops, as well as rotation, requires very careful study in detail before any hasty attempt is made to change immemorial custom.

The treatment of the individual trees, or of the crop plants, on the other hand, is probably capable of a good deal of improvement without such great difficulty. If the villager knew how to graft and bud, he might have his fruit trees improved by introducing new varieties. His methods of sowing broadcast are probably often capable of being improved to the saving of seed. He might very well learn the advantages of regular pruning of fruit trees on definite principles, of selection of good parents for seed, of better methods of propagation, of sound systems of manuring and other such matters. But the motto must be "festina lente," or perhaps still better "ca' canny," and every step proposed must first be carefully tested.

The next point in native agriculture to be considered is improvement in cleanliness of cultivation and freedom from disease. The mixed cultivation above mentioned is, of course, a considerable safeguard against disease spreading rapidly over a large area, or getting out of hand, as it has so frequently done in cases of "pure" cultivations of single products. The villager, however, has a lot to learn as to the need for cleanliness as a preventive against disease. For instance, in the Malay States a few years ago it looked as if he were about to lose his favourite cultivation, that of coconuts, through the attacks of the beetle pest. It is doubtful if any amount of teaching would have availed to save this cultivation, but a little compulsion has worked wonders, and has done much for the education of the villager in the need for cleanliness in cultivation. It therefore seems highly probable that a judicious extension of this system to other crops than coconuts, when the opportunity is afforded by some outbreak of disease, might be attended with good results, and afford the opportunity of improving methods as well.

The fifth point mentioned above for consideration was the possibility of improving native methods of preparing produce for market. As a rule, native produce is of inferior grade to that prepared by European planters. This is partly, of course, the result of bad cultivation, especially of want of proper feeding of the plants, but it is also due to ignorance, indolence, or carelessness in treating the product after it is harvested. The question of improvement is thus on all fours with that of improvement of methods of cultivation dealt with above. The fact that even with the object lessons of European estates before them, and with the practical lesson of lower market prices obtained, natives do not improve their methods, shows how difficult it is to do much in this direction.

There is also the possibility of improving native stock, whether of cattle, horses, goats, sheep, poultry, or pigs. But here again we must go slowly, and remember that the villager is very limited in capacity for supplying food, &c. If a sudden increase were made, for example, in the size and strength of the draught-cattle, the villager would be unable to feed the new beasts properly, and they in turn would be too large or strong for the agricultural implements in use. Improvement on the other hand can at once be put in hand in regard to methods of castration and many other points.

GUMS, RESINS, SAPS AND EXUDATIONS.

Area under Rubber in Ceylon.

A very good answer to those who are claiming that Malaya is the premier rubber-planting country is supplied by the statistics just to hand for the new Edition of Ferguson's "Ceylon Handbook and Directory," which show that the Ceylon area in rubber, or to be planted during this present south-west monsoon (and consequently probably nearly all planted by now), is no less than 104,000 acres, besides which there are probably 15,000 or 16,000 in native hands, amounting in all to 120,000 acres. Mr. Carruthers' report on the Federated Malay States for 1905 shows that at the end of that year they had only 38,000 acres planted in rubber with about 100,000 acres alienated for this product, and it is hardly likely that they can have planted the difference since. Even allowing that the Ceylon estimate is too much by 25,000 acres and the Malayan too small by the same amount, and allowing another 25,000 acres for the rubber in the Straits Settlements and Johore, will not make the figures meet.

It must be pointed out also, that if planting is to go on at this rate, it will not be long before the time of overproduction and low prices arrives. Already Ceylon alone contains perhaps enough for nearly one-quarter of the world's consumption.

J. C. WILLIS.

The Truth about Rubber Culture.

BY, DR. PEHR OLSSON-SEFFER.

USES OF RUBBER.

There are at present about one hundred rubber plantations in Mexico alone representing over $50,000,000, most of it American capital. It has been feared that when all these plantations are in full bearing there will be an excess of rubber in the market. If we estimate that these plantations have 20,000,000 trees, they would produce at ten years of age according to usual expectations twenty million pounds of crude rubber. Today the manufacturers of the United States use no less than 60,000,000 pounds annually. The Mexican plantations thus would supply only one third of the needs of this country, provided ten years old trees yield one pound of rubber, which they do not. It is much safer to estimate a 50 per cent lower yield.

Another objection raised against the safe future of rubber cultivation is the possibility of the discovery of a substitute for rubber, manufactured synthetically. It can be assumed that some chemist will succeed in developing some kind of substitute, or in discovering a process of synthetically producing rubber. But would this ruin the industry of rubber culture? Has diamond mining suffered from the discovery of making artificial diamonds? Has sugar cultivation become unnecessary because substitutes for sugar can be produced in the chemical laboratory or in the factory? Is wheat growing a hazardous enterprise because some scientists may discover a process for artificial production of the foodstuffs obtained from grains of wheat? Let us suppose that somebody succeeded in producing rubber from turpentine or from some other organic raw material. It is not likely that turpentine or any other similar raw material could be produced much cheaper than crude rubber, which is a natural product of tropical plants cultivated with the cheap labour of tropical countries, and extracted and prepared with modern machinery under supervision of modern science.

Any new rubber substitute should be hailed with delight by the rubber planter. As the substitutes can only be used as adulterants, as ingredients for mixing with the pure rubber goods, the more rubber articles will be used, and the greater will be the demand for pure rubber.

CULTIVATION POSSIBLE.

Is rubber culture a possibility? Can the rubber producing plants be cultivated? This has been answered in the negative by a number of persons who sit in their chamber and speculate, who write "expert" reports without knowing anything about the subject. Is there a plant which man has not been able to cultivate? Is there a cultivated plant which man has not been able to improve?

It has cost immense amounts of capital to ascertain the right methods of cultivation, but man has succeeded in making any plant he wanted, to grow for his benefit. He has also succeeded with the rubber plants.

We have a great number of plants that produce rubber, but there are only half a dozen which can be cultivated profitably for commercial purposes. Of these there are only two that really need to be considered, the Para rubber (*Hevea*) and the Central American rubber (*Castilloa*). The former is now cultivated to some extent in Ceylon and India, and has in places proved a success. In Mexico it is not likely that the Para tree will be extensively cultivated. In Brazil, its native country, very little cultivation has, as yet, been commenced, all the Para rubber coming from wild trees. Rubber planting is now done on a large scale in Southern Mexico, and this is at present the principal rubber culture country in the world. The cultivation is here confined exclusively to the native tree *Castilloa*.

INEXPERIENCE AND FRAUD.

In view of the fact that so much ignorance prevails and so little real knowledge exists in regard to methods of cultivation it is astonishing that the industry has reached its present state. It is in such ignorance we have to look for the greatest danger to the rubber planting business, because it has given opportunity for so much fraud. Numerous fake companies have been promoted in the United States for the purpose of developing rubber plantations that do not exist, and other companies have been greatly over-capitalised. The public has naturally become suspicious toward all rubber planting companies and many legitimate concerns have suffered.

It is, however, wrong to presume that, because fraud has been practised in many cases, every rubber plantation is more or less of a swindle. Banks have failed because of dishonesty; in every kind of business mismanagement, stealing and other similar proceedings have resulted in ruin and scandal. Still nobody would maintain that every bank was a very uncertain and risky enterprise. In every case we have to inquire into the integrity of the men standing behind the concern in question.

CAUSE OF FAILURES.

If we investigate the causes that have produced some of the most disastrous and sensational failures of rubber plantations we shall find that in every case such a company was not promoted as a "bona fide" and legitimate enterprise for the purpose of building up a successful plantation, but that the whole scheme was intended to benefit the promoters. In some cases the home office expenses have exhausted the entire capital, and little or nothing has been left for the development of the plantation. Some of these plantations have been started on soil which is in every way unsuitable for the cultivation of rubber. On others they have had no idea about the correct way of planting the rubber tree, and the plantations do not show a result corresponding to the outlay. Sometimes the development work has been greatly overpaid to the benefit of one or another interested party. Very often the management has lacked all experience of tropical agriculture. Even at present it would, in many cases, be well if the companies realized that there is a little difference between growing cabbages or potatoes and rubber trees. Most of the plantation managers are good, all-round business men, and would no doubt succeed in almost any venture in their home country. But in the tropics, where climatic and soil conditions are entirely different from those in the United States, where labour has to be handled in a way peculiar to the country, where another language than English is necessary in order to communicate with the people, a man with however wide agricultural or business experience, fresh from home, is sure to be expensive to his employers. The first requirement in establishing a tropical plantation is the right kind of soil and climate for the plant to be cultivated. Next comes an honest and competent manager. If the home end of the proposition is in good hands, there is not the slightest doubt but that rubber planting is a very profitable business.

RUBBER CULTURE DEMONSTRATED A SUCCESS.

It is by no means a mere assumption that the cultivation of rubber may prove a success. It has been fully demonstrated that the *Castilloa* tree can be grown profitably on a commercial scale, that it produces under cultivation a sufficient quantity of rubber to more than amply repay expenses, and that plantation rubber can be produced cheaper and better than the product from wild trees. Although none of the Mexican plantations are, as yet, in full bearing, we could enumerate several plantations where tapping is now regularly carried on, and where the returns show that rubber planting is no more an experiment than the growing of oranges. In each case we have to presuppose the existence of right conditions.

THE YIELD EXAGGERATED.

Lack of experience has in most cases led to over-sanguine expectations in regard to the yield of rubber from a plantation. Usually a few picked trees are tapped for the benefit of the inspecting shareholder and from the results a total yield is estimated by means of a simple arithmetical calculation. Such a proceeding is, however, of no value in obtaining an average yield of an agricultural crop. If one acre of corn yields 50 bushels, it need not necessarily follow that 10,000 acres would produce 500,000 bushels. If one rubber tree of a certain age gives one pound of crude rubber it is not proved that a million trees would produce so many pounds. Any one conversant with agriculture knows that estimates made on such a basis are without value.

There are companies who state in their literature that three to five pounds of rubber is obtained from trees ten years old. Whether such statements are due to ignorance or deliberate misrepresentation they do not in any way promote the interest of the rubber industry. The public cannot but remain doubtful before such exaggeration of facts. To imagine that any kind of legitimate enterprise in agriculture would give from 500 to 700 per cent. annually on millions of dollars invested is simply ridiculous.

The experience of the results of tapping is yet limited, but from actual tests we know the following averages are certain:—A plantation of seven year old trees will give two ounces to the tree, eight year old trees four ounces, nine year old trees six ounces, ten year old trees seven ounces, eleven year old trees eight ounces, and twelve year old trees ten ounces. It is possible that a larger return will be obtained, but so far we have no reliable evidence to show that such would be the case.

The average yield of ten ounces per tree from a twelve year old plantation means at least 30 per cent interest on the investment, and this ought to be sufficient for any shareholder.

SCIENTIFIC METHODS NEEDED.

During investigations of the rubber industry in Ceylon and in Mexico the writer was impressed by the difference of interest manifested by the rubber planters in these countries.

In Ceylon, although rubber planting is only a very subordinate industry, the planters frequently turn to the experiment gardens for scientific advice in regard to methods of cultivation. In Mexico, where such an immense amount of capital is invested in rubber plantations, the planters go on experimenting, each on his own account and according to his own notions, not with a small number of trees, but with the whole plantation representing hundreds of thousands in value. The shareholders have in many instances had to pay dearly for the experience of their manager. It would have been more economical and more according to modern American methods to employ scientific assistance for discovering the right methods and for investigating the various problems that confront the practical planter. There are a few planters who devote their spare moments to the solution of one or more of the numerous problems connected with rubber culture. But there is no co-operation and progress is slow. What the rubber planters need is a number of trained persons who can devote all their time to this purpose, who can visit all the plantations in the country, make a thorough study of the different problems, and make the results known to the general benefit of all the planters.

EXPERIMENT STATIONS IN OTHER COUNTRIES.

Where would, for instance, the sugar industry of the Hawaiian Islands stand at the present day had not the planters of that country co-operated and established a sugar experiment station. It is an acknowledged fact that the output of sugar from the Hawaiian Islands has increased many times as a result of the investigations in the field and laboratories by the scientific staff of the Hawaiian Sugar Planters' Association.

Similar instances can be given from different countries, and especially from the United States, where growers of fruit, corn, wheat, cotton, sugar and other agricultural products have associated and employed scientists to assist them in perfecting methods of culture, in fighting diseases, in improving varieties, in studying the questions of harvesting, preparing and marketing the crops. There can be no doubt of the necessity of similar organization for the American rubber planters of Mexico.

PRACTICAL BENEFIT OF STATIONS.

It is satisfying for those interested in rubber culture to know that the planters have generally recognized the importance of the immediate establishment of a rubber experiment station and laboratory in Southern Mexico. Only a few months ago action was taken in approaching all the companies with a proposal for co-operation to that end, and it has met with a ready response. There is, besides the wish for improvements in culture of the rubber tree, also a desire on the part of all the legitimate rubber concerns to organize and thus to prevent fraudulent enterprises from appearing. The public will soon recognize the standing of such companies which have been refused membership in the Planters' Association, and which are not visited by the scientists employed by this society.

The methods of gathering and handling the yield are still practically on the same level, where they have been since the Indian "ulero" began to roam through the forests in quest of rubber from the wild trees.

Experiments conducted by the writer during a three months' stay in Southern Mexico last summer have made it evident that by improvements in the methods of preparing crude rubber large sums can be saved. But it also became clear that whatever experiments are commenced they must be done on the spot where fresh material is always at hand. A product such as the milk of the rubber tree, which changes its character in a very short time, in less than an hour, cannot be transported, say, to Mexico City or the United States for laboratory experiments.

Experiments for the purpose of improving the quality of the rubber tree can naturally be conducted only on the place where the trees grow. And the possibilities of improvement of *Castilloa* by modern methods of plant-breeding are very promising. The eminent plant experimenter, Luther Burbank, in a recent letter to the writer says in regard to this matter: "I do not know of any other plant in the world which promises better results."

SOME PROBLEMS THAT NEED INVESTIGATING.

Matters that are now puzzling the rubber planters would be taken up and studied by the scientific experts, and the knowledge acquired would be of inestimable benefit to the planters. Such problems as the quality of soil best adapted to rubber culture, methods of planting, amount of shade necessary, care of the plants while growing, best mode of tapping, preservation of the trees after the tapping operation, transportation of latex, coagulation methods, and a variety of other questions which are of the greatest practical importance would be taken up.

These problems require immediate attention because the time is very near when wholesale tapping is to be commenced, and it means a considerable loss to the planters if these questions are not solved before that time.

To handle the immense amount of latex which is produced, say from several million trees on a single plantation, it is necessary to introduce machinery, and for extracting and preparing the rubber on a large scale many different devices have to be worked out.

It is evident that the better quality of rubber a plantation can place on the market the higher price will be obtained. The more rubber extracted from the milk the greater the profit. At present several per cent. of rubber is lost in the coagulation process, and where simply drying of the milk is employed, the product is of inferior quality and commands only a low price.

GOVERNMENT AID TO RUBBER PLANTERS.

In some of the Central American countries the government has stepped in and is in every way encouraging rubber planting, even by paying a bonus to the planters. The Mexican government has so far not done anything toward assisting the rubber planters of their country. The publications on rubber culture published by that government are unreliable and more of the character of the prospectuses issued by private companies, zealously avoiding anything that might be interpreted as unfavourable, but not hesitating to paint the future in the most vivid colours.

A very creditable position in this matter has been taken by the United States Government. Although the rubber planting is done outside of U. S. territory, the government has been investigating this industry in the interests of the American investor. A few years ago a scientist of the Department of Agriculture was commissioned to study the matter and a report was issued. Recently the late U. S. Consul General in Mexico City, the Hon. James R. Parsons, Jr., who was devoting much time to this question, personally visited a number of plantations in districts, and subsequently furnished the Washington Government with exhaustive reports, only a few of which have so far been published.

This official was also up to the time of his lamented death endeavoring to show the government the necessity of sending an expert to Mexico to visit every rubber plantation in the country and to supply the government with detailed reports upon these plantations. The many disclosures of recent date of mis management of rubber plantations has caused the government to issue fraud orders prohibiting fraudulent concerns from using the U. S. mail, and in order to be prepared the government wished to have expert opinion upon each plantation so that no injustice should be done.

RUBBER PLANTING AS AN INVESTMENT.

In conclusion we wish to state that after a thorough, impartial investigation of the various sides of rubber planting, we feel confident that this industry offers a safe and profitable investment, provided the conditions indicated above are present, that is, "if soil and climate are good, and the management honest and competent." With the establishment of rubber experiment stations in the hands of American scientists and co-operating with the Governments of the United States and the Republic of Mexico an additional safeguard for the investors will be provided.—*The Mexican Investor*, March 1906.

(Dr. Olsson-Seffer is the head of the new Rubber Experiment Station in Mexico, and has had much experience in rubber culture. This report, therefore, may be taken as authoritative.—Ed).

The Cultivation of the Castilloa Rubber Tree.

THE METHODS EMPLOYED ON A NICARAGUA PLANTATION. III.

TREATMENT OF RUBBER AFTER COAGULATION.

After coagulation rubber is not thoroughly dry. It loses a large amount of its weight the first day or so. The amount lost varies with the method by which it has been coagulated, but is less in dry coagulation. It also varies with the thickness of the rubber. Thin rubber loses the greater part of its weight immediately, while thick rubber loses a little at a time over a long period. As it dries it loses stickiness and becomes translucent. I do not believe it is thoroughly dry until it is entirely translucent—of course rubber with dirt and bark in it can never be entirely so—and has lost the greater part of its stickiness. I have seen no rubber which had no stickiness, but it can be so far reduced as to allow it to be folded on itself without cohering. Some chemicals such as ammonia, will so affect latex that the rubber becomes black and does not become translucent. I believe that rubber, to be at its best, should be kept at the plantation in a room with artificial heat until showing signs of being thoroughly dry.

Most chemicals have peculiar effects on black water, and some on latex. I do not understand these actions, but as they might lead to some discovery later, I think they should be recorded.

Sulphuric Acid:—This acid acts differently according to the strength of the solution. Weak solutions of acid effect the peculiar half-coagulation of latex, and turn black water pale yellowish, forming a precipitate slowly. This precipitate is very fine and goes through filter paper. It settles at the bottom of the tube after a few days, when it can be separated by decantation. The precipitate is pale yellow, like the black water. Very strong or concentrated sulphuric acid acts differently when in greater quantity than the black water. A mixture of 80 per cent black water and 20 per cent concentrated acid is pale yellow, while a mixture of 80 per cent concentrated acid and 20 per cent black water turns deep black. Such a proportion of acid and latex does not coagulate the latex. A mixture of 50 per cent of each is of a deep reddish colour, and it is only when mixed in such proportion that sulphuric acid causes coagulation.

Hydrochloric Acid has at all times the same action as weak sulphur acid. The pale yellow colour cannot be distinguished from that given by sulphuric acid. Concentrated acid acts in the same way as a weak solution.

Nitric Acid acts like hydrochloric acid, except that the colour of both black water and the precipitate formed are deep orange. Concentrated nitric acid acts in the same way on black water, but oxidises the latex forming a brittle orange substance which becomes powdery when dry.

Lime Juice acts like hydrochloric acid on the black water, but when in the right proportion and under suitable conditions, it coagulates the latex.

Sodium Hydroxide makes a very white latex, but turns the black water a deep brownish red. Ammonia turns pure latex to a yellowish colour, which on the surface when exposed to the air becomes green. Latex to which water has been added turns greenish, and the black water becomes a very deep black on addition of ammonia. Ammonia is a good substance to use in keeping latex from coagulating. Latex may be kept pure for a long time without coagulating if ammonia is in it. The actions are the same in concentrated and very weak ammonia. A solution of ammonia, ·001 per cent, will show these actions nearly as strongly as concentrated ammonia.

Sodium Carbonate acts practically in the same way as sodium hydroxide, except that on one occasion it effected coagulation. Sodium Chloride has no action on black water, but gives half-coagulation with latex. Calcium Chloride causes no colour change in black water, but forms a dark-coloured precipitate. It half-coagulates latex. Copper Sulphate, Zinc Chloride, and such salts act like weak acid. Black water boils down to a black solid substance which might be found of some commercial value, and could in that case be sold as a by-product. Sugar has a slow action on black water which is not noticeable for two or three days, but after that begins to take away the black colour and leave a pale liquid. Black water treated with acid or other chemical substance and boiled down, turns black just before dryness and forms apparently the same black substance as is formed by pure black water.

ARGUMENTS REGARDING LATEX.

What value latex is to the tree is still an open question. I think that it is simply a protection against insects and evaporation whenever the tree is wounded. Anything striking against the outside bark, if it hits hard enough, will bruise the inner bark so that the latex flows. An examination of the place a day or two later will show a thin coat of rubber entirely covering the bruise. Tropical trees do not have the thick outer cork bark of nothern trees. Anything striking them is liable to bruise the inner bark. This sheet of rubber would protect the bruise from too much evaporation and from insect attacks. Leaf-cutter ants do not attack the leaves of *Castilloa* and cattle do not seem to be fond of them, but I believe this is not due to the latex but to the thick coat of epidermal hairs, a thing which few tropical trees seem to possess. It is noticeable that ants do attack *Hevea* which has not a hairy leaf.

The study of the stucture of the latex shows that it has two distinct parts; watery solutions and solid substance in minute globules. The watery contain no rubber. They contain the substance which forms the residue of the black water, though this substance is apparently changed by oxidation before becoming black water. They may also contain sugars and proteids, as these substances are evidently there, but it is more than likely that these substances are not in the original latex, but come from some other bark tissue than the "milk tubes."

BLACK WATER.

Latex which is quickly gathered and quickly corked up away from the air forms no black water. Black water gets blacker from longer standing in the air until about five days after gathering. Fresh black water can immediately be turned to its deepest black by ammonia, but ammonia will not affect black water five days old. I believe that the action of ammonia is the same as the oxidation in the air. Contact with metals will make black water blacker. Sugar slowly takes the black colour away, and latex which has been allowed to oxidise has water which resembles that formed by sugar. I believe that sugar reduces it to its former state. I do not see any reason to think that rubber itself is an oxidation product; it is possible, but if so, it can be further oxidised by the use of nitric acid.

YIELD OF CASTILLOA.

I believe that accounts of the yield of the *Castilloa* tree have been greatly exaggerated, either by intention or by mistake. Great care must be taken in trying to estimate the yield. Natives will not count half the trees they tap, and in that case the yield will appear to be more than double what it really is. Here, owing to poor soil, wrong methods of tapping etc., the trees are irregular in their growth. It does not pay to tap only big trees, and the little ones bring down the average. The average yield for trees eighteen or twenty inches in circumference should be between one and two ounces per tapping. I think it would be safe to calculate on half-a-pound a year from good six year old trees.

In calculating yields it makes a difference whether the rubber is weighed immediately, or after drying some time. Rubber made wet by coagulation and apparently dry will lose sometimes as much as 20 per cent of its weight in the first day's drying. What the trees will yield in the future cannot be definitely determined. Two wild trees gave between one and two pounds each to a tapping, using ladders. These trees were both a few inches over three feet in circumference. At the present rate of growth the tree should reach that size when about fifteen years old. It is probable that the wild trees were older, as they were growing in the shade until the land was cleared.

THE OCCURRENCE OF RESIN IN YOUNG TREES, AND GROWING PARTS OF TREES.

Experiments of others have shown that young trees and younger parts of old trees contain a large percentage of resin in their rubber. I have made one observation which suggests a reason for this. In cutting a temporary branch of leafy stem it is noticeable that the latex comes very close to the outside bark, and that there appears to be a second ring of tubes, in the inner bark. Microscopic examination of these parts shows a large number of collenchyma cells close to the outside bark. These cells are similar to bast fibres, but the thick part of the walls is not uniform. Collenchyma cells are never formed by older trees except in their young parts. I think it possible that these collenchyma cells carry latex which is richer in resins than ordinary latex, and which may possibly be entirely resin.* Of course these collenchyma cells remain in the plant as it grows older, but form a very small proportion of its tissue at that time. It is possible that rubber or resin may have some chemical relation to the cellulose of which the thick walls of both collenchyma and bast fibres are formed.

CASTILLOA VERSUS HEVEA.

The Para rubber tree shows some important differences in its latex from the *Castilloa*. Of course, all that I have noted in this tree is done here in Nicaragua, and it may behave differently in Brazil or Ceylon.

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* Collenchymatous cells contain neither latex nor resin.

The first noticeable thing in cutting the Para tree is the small yield. A *Castilloa* tree when first tapped fills the cut with latex immediately, and the latex runs in a small stream from the lower end. A *Hevea* when first cut shows no latex. In a few seconds it begins to appear in drops on the cut surface, and after three or five minutes begins to drip from the end of the cut. The small yield at the first tapping seems to be balanced by the fact that more can be got by multiple tapping. In Ceylon, according to report, the yield increases each day, but here I have noticed no increased yield. I tapped one tree nine days in succession, and though it yielded every day (a thing which *Castilloa* would not do) the yield decreased instead of increasing. The *Hevea* tree will not do here because there is too much labour involved in multiple tapping. I think the trees here if tapped rightly would yield as much as those in Ceylon, but as labour here costs 60 cents a day, and there tenpence, it would not pay. I am confident from comparing yields printed in the *India Rubber World*, that *Castilloa* will yield as much with four operations a year as *Hevea* will with ten or twenty when the trees are the same age. *Hevea* latex is superior to *Castilloa* without doubt in all points but one. It coagulates very easily, and is therefore harder to bring from the field than *Castilloa*. *Hevea* latex is finer than *Castilloa*. It has no black water. All that is necessary to coagulate it into good rubber is to set it in a shallow dish and leave it twenty-four hours. The piece of rubber can then be rolled to squeeze the water out, and then be dried. The *Hevea* globules are finer than *Castilloa*, and they are not in masses. For this reason *Hevea* latex cannot be coagulated by the blotter method, as the globules soak right through. It might work on porous tiles.

Hevea rubber I do not consider superior to *Castilloa*. In point of strength and elasticity my observations have seemed to show that it is inferior. Pieces of *Castilloa* and *Hevea* rubber coagulated at the same time showed that Castilloa could not be broken by stretching, while *Hevea* would break square across. The only piece of *Hevea* I have seen which was stronger than *Castilloa* was a piece from Ceylon, which was fully three times as thick as the *Castilloa* it was compared with. It may be that there are some manufacturers' differences between *Hevea* and *Castilloa* that may make *Hevea* superior, but in point of strength and elasticity it is not so.

THE CEARA RUBBER TREE (MANIHOT GLAZIOVII.)

The Ceara rubber trees here are only two years of age, and are yet to be tapped. They are very fast growers, and are nearly as large as four-year old *Castilloa* trees. Their bark is not as thick in proportion, however, as *Castilloa*, and for that reason they yield less. The latex runs as freely as *Castilloa*, but is finer, and like *Hevea* has no black water. It is rather watery. The rubber has a peculiar unpleasant odour. I have not seen enough of it to judge its qualities.

The Ceara rubber trees are not doing well. They die from no apparent cause. The very healthiest looking and fastest growers will suddenly begin to wilt. Some of them are attacked by insects, but these appeared to come only after the tree had begun to die. I believe that they are sensitive to lightening, though I am not sure of this.—*Quarterly Journal, Liverpool Institute of Tropical Research.*

EXPORTING SEED OF PARA RUBBER.

As it is well known the seed of the Para rubber tree deteriorates very rapidly after it is ripe and soon loses its germinating power; it is not always easy to send seed long distances without a very large percentage of losses, at the same time the demand for the seed in distant parts of the world is very considerable and a good many experiments have been tried in the Botanic Gardens in various methods of packing to ensure their arrival in good condition. The reports received from the recipients of these seeds have been remarkably good, as the following records will show:—

Of 7,500 seeds sent to Jamaica on August 31st, were received on November 21st, and Mr. Fawcett writes: "The 7,500 seeds sent in biscuit-tins are all germinating very well, and we shall scarcely lose 500 of them."

One hundred were sent in a similar manner to Calabar on the date July 6th, and arrived on September 20th.

The acting Secretary writes in reply: "The seeds were soaked in water for two days on their arrival and were then planted with the upper portion left above the soil. Ninety of the hundred seeds have already germinated (November 7th), and appear healthy young plants.

The Royal Gardens, Kew; 135 seeds were sent on July 6th, packed in charcoal, in a biscuit-tin. They arrived in a month, and 123 germinated.

On February 12th, 1903; 20 seeds were sent to Mr. J. C. Harvey, Vera Cruz, Mexico, who writes, May 19th, 1903, that "out of the 20 seeds of *Hevea Brasiliensis* I have 14 young plants. They came up in a few days, and possibly a few more may germinate, though three seeds were decayed."

These were all sent in biscuit-tins. Those sent to Jamaica were packed in slightly damped incinerator earth, but it was necessary to replace the upper part of the packing with sawdust to reduce the weight, as incinerator earth is very heavy and the box, a two-pound tin, which contained 150 seeds, would have been over parcel post weight.

The other tins were filled with damp charcoal finely powdered. In packing, a certain amount of care is required in damping the charcoal so as to get it equally moistened all through, and not over wet or over dry. This is best done by damping the charcoal thoroughly and then drying it in the sun, constantly stirring and turning it over, till it is uniformly slightly damp.

The incinerator earth which had been exposed to the elements was damp when received and only wanted partial drying to fit it for packing. Its weight is against its use, but both it and the powdered charcoal have the great advantage of preventing any attacks of mould or bacteria likely to cause decomposition.

Other experiments with powdered coir fibre, and coir dust, saw dust and variously prepared soils have been tried, but the results do not seem to have ever been as successful. One experiment was made in putting the seeds in water for a month, but though that might be effective for a fortnight or so, they had all perished by the end of the month.—*Agricultural Bulletin of the Straits and Federated Malay States*, January, 1906.

REPORT UPON A VISIT TO GREAT BRITAIN TO INVESTIGATE THE INDIA-RUBBER INDUSTRY IN ITS RELATION TO THE GROWTH AND PREPARATION OF RAW INDIA-RUBBER IN THE MALAY PENINSULA.

By P. J. Burgess.

Early in 1905, at the request of the United Planters' Association of the Federated Malay States, supported by the Federated Malay States Government, the Government of the Straits Settlements seconded me on special duty for six months, and I travelled to Europe to investigate the condition there of the India-rubber industry with the object of enabling the India-rubber planters and the producers of the raw material in the East to supply their rubber in the form most suited to the needs of the manufacturers, and by bringing the East and West into touch to stimulate the growth of the rubber planting industry. I left Singapore on March 2nd, and arrived in London on March 26th.

2. My first action on reaching London was to set about obtaining official introductions to various India-rubber manufacturers through the Colonial Office, the War Office and the Admiralty, and to amplify those private introductions with which I had been supplied in the East.

CREPE RUBBER.

3. Until the spring of 1905 all fine plantation rubber had been shipped in the form of flat sheets or "biscuits" prepared from the rubber latex by simple coagulation in pans with the addition of acid, squeezing the coagulated sheet under a hand roller and then drying with or without the aid of heat. A new method of preparation had been introduced in the Malay States involving the washing of the coagulated rubber on a power-driven machine between metal rollers, and the resulting rubber was produced in the form of crêpe or washed sheet. Small samples of this rubber had been submitted to various manufacturers for report, but the first large shipment with which to test the London market arrived in London towards the middle of April. In order that this should be fully brought to the notice of the buyers and manufacturers, I wrote and published an account of its history and preparation in the "India-Rubber Journal," whose Editor had always taken great interest in all attempts to improve plantation rubber. An offer of samples was also made in the Journal, and samples of the rubber were subsequently sent by me to a number of the principal rubber manufacturers. An analysis of the rubber was made by Mr. Ballantyne, of Chancery Lane, a copy of which was shown with the sample of the rubber at the sale rooms.

BUYERS' VIEWS OF CREPE RUBBER.

4. The sale took place on Friday, May 12th, in Messrs. Figgis' sale-rooms, the market was firm and prices were high. Much interest in the crêpe rubber had been shown by the buyers, but the majority of the opinions openly expressed were adverse and critical, since the samples were of a kind new to the buyers. When the first lot of the crêpe was put up there arose from the head of the room a cry of "We don't want washed rubber, we want to wash our own," which plainly showed the nature of the opposition. However, in spite of this open disapproval on the part of some, the rubber sold at 6/8 and 6/8½ per lb. which was 1*d.*—1½*d.* above the price on the same day, and in the same sale, of fine plantation "biscuits" clean and dry and with which no fault could be found.

5. The cause of this action on the part of the buyers was not easy to determine. No pretence was made that the rubber after washing was injured or made inferior to "biscuit," or that it would be less readily accepted by users of plantation rubber, and no explanation other than the statement that washed rubber was not wanted could be obtained from the objectors themselves. An explanation of the disapproval which seems reasonable, supplying as it does a personal motive, was obtained later from indirect sources. Raw rubber is not bought direct by the manufacturers at auction, but from the "buyers." The latter buy in bulk and divide their purchases into lots of different qualities (usually into three) and sell this regraded rubber at different rates, making a substantial profit on this transaction. A rubber of standard quality, uniform, clean and pure such as crêpe or plantation-washed rubber offers no opportunity for this sorting and grading process, and the profit derived from dealing in it would be less. A further possible explanation is that with a pure rubber of uniform quality an opportunity for direct buying on the part of the users of the material would be afforded.

MANUFACTURERS' VIEWS OF PLANTATION RUBBER.

6. By all the manufacturers a keen and lively interest is shown in plantation rubber and in the prospect of being able to obtain rubber of fine quality from the East. The immediate need is for quantity, and exaggerated views of the amount that is to be expected in the near future from plantations were prevalent. No inclination to deal directly with the producer in small lots of a few tons was shown by any of the larger manufacturers, the difficulty being that the supply would be too small and irregular to justify any departure from methods of buying already in practice, and added to this is the fact that plantation rubber is of a different quality and grade from any other in the market, and it requires treatment different in detail in practical working; that the rubber should be clean, dry, and free from mechanical impurity is essential, and in these respects plantation rubber has already gained a considerable reputation. That it should be free from any trace of softening or stickiness is still more important, rubber which is "tacky" in the slightest degree cannot be relied upon in practical use. Unfortunately there has been a considerable amount of rubber showing this defect of softness with a sticky and tacky surface, produced on plantations, and these samples have tended to injure materially the reputation of plantation rubber.

7. The form in which the rubber is exported—whether in sheets, biscuits, crêpe (washed rubber), or worms, as produced in Ceylon—is not a matter on which the manufacturers expressed any very decided opinions. As long as the rubber is evidently dry and clear enough to show by inspection the absence of any mechanical impurity, the precise shape and form of the rubber is considered of comparatively small importance, although preference for rubber in the form of crêpe was shown by some, and all with one exception were agreed that it was as good a condition for packing and exporting rubber as any. The fact that crêpe rubber has been subjected to a washing process is not at present regarded by the manufacturers as of much advantage. Plantation washed rubber for ordinary purposes need not be re-washed and re-sheeted, but this same advantage applies also to clean biscuit, sheet, or worm rubber. For special purposes all forms of raw rubber would be re-washed in the factory. The advantage of crêpe rubber would be felt when larger bulk of it is put upon the market, because greater uniformity of quality and appearance could be maintained. Up to the present this has not been of practical importance in dealing with small parcels of a few tons or fractions of tons, but it would be a distinct advantage to have perfect uniformity when dealing with large bulk and regular shipments, and this is secured by the mechanical washing and mixing in

bulk which results in the production of crêpe rubber. Although at present neither clean biscuit, sheet, worm, nor crêpe rubber need be washed for ordinary use, yet if washing and sheeting plantation rubber is to be dispensed with in the manufactory, it would be a great advantage when dealing with the larger quantities to have it ready in the washed and sheeted form, and the advantage of crêpe over other forms would be most marked when dealing with many tons at a time.

ADULTERATION OF WASHED RUBBER.

8. There is one danger connected with the use of a washing machine on a plantation. By its means adulteration with inferior rubber, rubber substitutes, and recovered rubber, could be carried out without possible detection by eye or and inspection, although chemical analysis or practical use of the rubber would, reveal the sophistication. In unprincipled and fraudulent hands such adulteration might be carried to a considerable pitch before detection occurred, and this possibility of misuse should not be lost sight of by those who are responsible for the purity of the rubber produced.

ANALYSIS OF RUBBER.

9. The chemical composition of rubber has no consideration either from the buyers or the manufacturers—the former base their valuation entirely upon the appearance, feel, smell, and apparent strength of the rubber when pulled about in their hands, the latter rely chiefly upon the way the rubber works upon their machines during manufacture, though in a few instances properly controlled and systematically carried out tests of tensile strength and elasticity are made with samples of the rubber prepared and vulcanised. The percentage amount of the impurity which is inherent in the rubber, and which cannot be removed by washing —that is, the oily, resinous, and nitrogenous, or proteid, impurity—is practically never determined in the factory, and a statement of these values with the rubber for sale would neither be understood nor attended to. In the present state of ignorance as to the influence of these ingredients upon the working qualities of the rubber during manufacture, the apathy with which variations in their amounts in the raw material are regarded is natural and quite intelligible.

PACKING.

10. There are several points which must be remembered in packing rubber Rubber at temperatures above 65°F. is naturally adhesive, and clean surfaces pressed into contact tend to stick to one another, though the rubber be dry and show no vestige of tackiness. Rubber during transit invariably shrinks in bulk owing chiefly to the action of its own weight in compacting the mass, and partly perhaps to a natural shrinkage of the rubber substance with the ageing of the rubber. Dust and grit which find way inside the cases adhere to the rubber, The care requisite in packing, therefore, depends upon the form in which the rubber is shipped. If in clean washed crêpe, which it is hoped will be used without further washing and sheeting, every care should be taken to prevent the layers adhering to one another, and to avoid the use of any packing material which can make a dust out of itself, or which will admit dust and grit from outside. This can be effected by the use of clean, well made and fitted cases, which should not contain more than 80-100 lbs., of rubber, and which might with advantage be partitioned to prevent the whole of the rubber resting with full weight upon itself. No inner lining of common paper or other friable material should be used—such wrapping is bound to get broken in transport, and particles of it work their way between the layers of rubber, and obstinately adhere to the rubber. The first shipment of crêpe rubber which I saw unpacked had been in wooden cases with paper lining. When the folds of separate layers of rubber were pulled apart, a shower of fine grit particles of paper, and dust, was then thrown out from the rubber. This rubber

though well cleaned and washed on the estate, would for fine work have required re-washing. The separate sheets of crêpe had adhered firmly into one solid mass which required a crowbar to separate into the original layers, and the whole had shrunk leaving a space of about an inch between the rubber and the sides of the case. If any wrapping to prevent the intrusion of dust and grit be used, it should be either smooth and strong such as sheet zinc lining or else made adherent to the sides of the cases—as, for instance, strips of smooth paper pasted over the joints in the wood inside the cases. With less perfectly prepared rubber in biscuit, or worm form, which will require washing before use, a less careful form of packing might be adopted. It must be, of course, always remembered that the rubber is valued by its appearance very largely, and uniformity in size and colour of the sheets will have some influence in determining the price, though really being no guide to the actual quality of the rubber.

QUALITY OF PLANTATION RUBBER.

11. On this subject I met with a perfect uniformity of opinion among those who had practically made trial of Straits and Ceylon rubbers. All were agreed that the rubber was good and very serviceable, but that it was by no means as good as South American fine Para, either hard or soft cure. The plantation rubber is lacking in nerve, it works soft between the masticating rollers, and its keeping qualities are inferior to South American Para. After vulcanisation the tensile strength is less and the elastic recovery of shape after deformation by stretching or compression is less perfect than shown by South American Para under precisely similar conditions. This result is disappointing and quite contrary to the report which the late Dr. Weber made on plantation rubber, when he stated that he found the tensile strength to be superior to that of South American hard-cure Para.

12. That the result of practical experience of the rubber manufacturers must be accepted there can be no question. There was no hestitation on their part in demonstrating to me the difference in working of the two classes of rubber, and in several cases—notably at Silvertown, where accurate tests of all rubbers used are carried out, the recorded figures were submitted to my inspection, and an inferiority of from 8 per cent. to 15 per cent. with different samples were shown. The inferiority of plantation rubber is not only confined to those physical properties which are capable of immediate measurement, but is also shown in the keeping qualities of the rubber. I was shown samples from different estates in Ceylon and the Straits which had been sent home in 1902 and 1903, and which had been preserved in air-tight jars side by side and in the same room with samples of jungle rubbers from South America and Africa. One sample prepared in 1902 was quite perished and rotten, its elasticity was entirely lost, and it was more like a sheet of dough than rubber. Other samples of plantation rubber had all shown marked deterioration in the three years. To compare with these were samples of South American Para of ages up to and over forty years which had preserved perfectly their tough and elastic qualities. This feature of plantation rubber is one which is now beginning to be realised, and though it probably is due to errors committed in preparation of the samples in question two or three years ago, it confirms practical users of rubber in their opinion that plantation rubbber is not reliable, and certainly not the equal of South American Para.

13. The cause of the inferiority of plantation rubber when compared with pure South American Para rubber is not known. Some of the manufacturers believe it to be due to differences in the locality, climate, and conditions under which the trees are grown; others incline to the belief that the difference in quality is the result of difference in mode of curing and exporting, and again the difference in age of tree from which the rubber is gathered may very probably be the actual reason for the difference in quality of the rubber. There is a further suggestion which has, I believe, never yet been made. The rubber trees of South America which are tapped

are selected both by natural and by artificial selection. The condition in South America is, I understand, one of jungle in which the trees affect, and compete with, one another, and this leads to the survival, by natural selection, of the finest and most sturdy only of the seedlings. The native in tapping selects the best of the trees he conveniently can, and here the influence at work is one leading to the rejection of weak and badly developed trees. On the plantation after the first selection of the stumps and seedlings, no further selective progress is actively at work. To determine whether this has any influence on the quality of the rubber, tapping should be done on specially selected trees, and the quality of the rubber extracted compared with the average rubber of that plot of trees. All opinions at present must be looked upon as guesses at the solution of this question, the only thing certain is that plantation rubber is inferior, and this certain knowledge is one of the most important results of my visit to England. I propose to endeavour to find out in Singapore, and on the plantations themselves, the actual reasons of this inferiority by experimental work; and to this end I have had made in Manchester, by a firm of manufacturers of rubber machinery, at the expense of the Colonial Government, machines for practically working up and vulcanising rubber, and I intend with the aid of these machines to manufacture test pieces of vulcanised rubber from raw rubber taken from trees grown in various localities of different age and cured in different ways. With these samples of vulcanised rubber physical tests of elasticity and tensile strength will be carried out, and a just comparison of the samples among themselves, and with true South American Para can be made. There are special difficulties in carrying out physical tests on india-rubber, and there is at present no uniform method of stating results; comparisons between tests made by different places are therefore of little value, and it is essential that all the work be done in the same manner on the same type of apparatus, to eliminate the personal equation and correctly ascribe to each variant factor in the production of the raw rubber its consequent variation in the quality of the product. When this is done I shall be able to say with certainty which method of preparation gives the best results, and to ascribe correctly to each and every one of the variable conditions under which the rubber is produced its true influence on the quality of the rubber. This work I look upon as being important, and it will, I trust, settle decisively many of the problems which now are controversial. To see clearly the necessity for the work, and to have gained the insight into the methods of treating and vulcanising rubber necessary for carrying it out, are the direct results of my visit to England, and the time spent in the works of the rubber manufacturers there.

(*To be continued.*)

A NEW ERA IN RUBBER EXTRACTION.

There has been developed, principally in connection with the Mexican shrub known as "Guayule," a very considerable interest in the extraction of commercial rubber from plants not adapted to any method of tapping. Many processes have been utilized, all based in part upon the maceration of the plant as a whole, and the ultimate separation from the mass of all the rubber contained.

As is well known, very much of the world's present supply of rubber is obtained by methods other than the tapping of the trees. A vast amount of rubber—including the South American grades marketed as "Caucho," or Peruvian —has always been collected by felling the trees and "ringing" trunks at frequent intervals, to allow the latex to escape. Gutta-percha and Balata are obtained in the same way. The *Landolphia* climbers in Africa are torn down from the forest trees, and cut into small pieces, from each end of which the latex exudes. Some millions of pounds more of rubber are gained in Africa from plants which contain the material only in the roots, the bark of which is beaten off with stones, the gummy mass resulting being boiled by the natives to separate the rubber.

It is these various practices that have so rapidly narrowed the native sources of rubber. They are all due to the fact that so much more rubber is available from certain trees and plants by other means than tapping; the "root rubber" could not be obtained at all by tapping. Before cultivation was introduced it seemed likely that in time only the *Hevea* species would be left as the world's ultimate dependence, as these are invariably tapped, even in the most remote forests. Under cultivation, however, the *Castilloa*, *Kickxia*, and some other species are capable of being tapped successfully, but there remain a number of other plants, valuable for rubber, which are not likely to yield at a profit without the destruction of the plants.

There is thus suggested a much wider field for the scientific processes lately introduced in Mexico than in merely exploiting Guayule rubber. If the *Landolphia* climbers, for example, must be sacrificed, their yield ought to be largely increased, by scientific methods, over what is now obtained by the rude practices of the Congolese. It may be that some of the species not capable of being tapped will yet be cultivated extensively, with a view to destroying the plants and the final systematic extraction of all the rubber they contain. It would not be surprising if the owners of some of these processes, in the hunger for rubber, should even acquire plantations of trees capable of being tapped, in order to gain an immediate large return. No doubt the widespread success of the new scientific treatment here referred to will temporarily increase the output of rubber from certain sections, but it will only hasten the destruction of existing rubber-yielding plants. In any event the rubber planting interest of to-day has nothing to fear from the new condition; it may yet be the means of opening a new field for profitable planting.

It has been asserted, though of course accurate data are lacking, that more rubber can be obtained from a five-year old tree by cutting it down and extracting all the latex than by tapping it for five consecutive years. The question may occur to some people, therefore: Why not do it, and replant?

There has been much condemnation of the wholesale destruction of wild rubber trees in Central and South America, whereby the unlettered natives have gained so much rubber. What will be said if scientific rubber hunters in the near future sweep over those countries, buying rubber plantations only to grind up the trees, and scouring forests for other latex bearers, every shred of which will disappear in the capacious maw of an extracting machine? But such a proceeding need not be viewed with horror. The main thing is to get rubber, and to get it quickly. The trees are not sacred, but only the rubber in them. Why not get it out, and in use, and replant fast enough to more than make up for what are destroyed?—*India Rubber World*, June, 1906.

CONSUMPTION OF INDIA-RUBBER BY THE UNITED STATES AND CANADA. (In Tons.)

[From the Annual Statistical Summary of Albert T. Morse & Co., Brokers, New York.]

Details.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.
Imports to United States ...	16,152	15,347	16,420	14,643	16,182	14,333	17,671	18,620
Exports to Europe	982	491	714	391	324	500	250	150
Net Imports	15,170	14,856	15,706	14,252	15,858	13,833	17,421	18,470
Add Stock January 1 ...	1,260	1,086	1,217	1,037	1,420	558	641	744
Aggregating	16,430	15,942	16,923	15,289	17,278	14,381	18,062	19,214
Less Stock end of year ...	1,086	1,217	1,037	1,420	558	641	744	591
Deliveries to Manufacturers	15,344	14,725	15,886	13,869	16,720	13,750	17,318	18,623

Details.	1899.	1900.	1901.	1902.	1903.	1904.	1905.
Imports to United States ...	23,095	20,468	23,208	21,842	24,760	27,623	28,635
Exports to Europe	300	450	680	430	490	274	357
Net Imports	22,795	20,018	22,528	21,412	24,270	27,349	28,278
Add Stock January 1 ...	591	712	1,198	1,399	331	256	305
Aggregating	23,386	20,730	23,726	22,811	24,601	27,605	28,583
Less Stock end of year ...	712	1,198	1,399	331	256	305	537
Deliveries to Manufacturers	22,674	19,532	22,327	22,480	24,345	27,300	28,046

—*India Rubber World*, February, 1906.

THE LONDON RUBBER MARKET.

London, June 8th.—At to-day's auction, 184 packages of Ceylon and Straits Settlements plantation grown rubber were under offer, of which 123 were sold. The total weight amounted to about 8 tons, Ceylon contributing 3½ and Straits Settlements 4½. The quiet tone ruling before the holidays was again in evidence. Demand, as at last auction, ran chiefly on the finer kinds, and one or two parcels showing particularly fine quality were well competed for up to 6s. 1½d. per lb., a price which was paid for some Ceylon biscuits from the Ingoya estate. The figure generally paid for fine biscuits was 6s. 0¼d., being a decline of about ¾d. per lb. on last rates. There were some parcels of crêpe of the darker qualities offering, the darkish of which were again rather neglected. For fine scrap competition was good, but the lower kinds lacked attention. Plantation biscuits and sheet to-day. 6s. to 6s. 1½d., same period last year, 6s. 5d. to 6s. 9d. Plantation scrap. 4s. 6d. to 5s. 2d., same period last year, 4s. 6d. to 5s. 7¼d. Fine hard Para (South American). 5s. 3d., same period last year, 5s. 8½d. Average price of Ceylon and Straits Settlements plantation rubber.—123 packages at 5s. 8d. per lb., against 106 packages at 5s. 9½d. per lb. at last auction.

Particulars and prices as follows :—

CEYLON.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
Langsland	2 cases fine amber biscuits, 6s. 0¼d.; 1 case darker, 6s. 0¼d.
Arapolakande	3 do fine darkish and dark biscuits, 6s. 0¼d.; 3 cases black, 6s. 0¼d.; 2 cases darkish scrap, 5s. 1d.
Ingoya	2 do very fine palish amber biscuits, 6s. 1¼d.; 3 cases slightly darker, 6s. 1½d.; 2 cases fine palish scrap, 5s. 1d.
Galatura	1 do darkish dull biscuits, 6s. 0¼d.
Halwatura	1 do palish to darkish scrap, etc., 5s. 1¼d.
H.L.K. (in diamond)	2 do small cloudy Ceara biscuits, 6s.; 1 case darker, 6s.
D. C. (in diamond)	13 do pale to dark biscuits (part Ceara), 6s. 0¼d.; 1 case darkish biscuits, 5s. 11d.; 1 case scrap, 5s.; 1 case heated scrap, part loaded, 3s. 6d.; 1 case rejections, 5s.; 1 case scrappy rejections, 4s. 9½d.

STRAITS SETTLEMENTS.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
S. (in diamond) R.R.	5 cases fine amber sheet, 6s. 0¼d.; 1 case darkish pressed scrap, 4s. 6½d.
P.S.E. (in diamond)	5 do fine amber sheet, 6s. 0¼d.
Jebong	4 do good darkish scrap, 5s. 2d.
D.W.H.S.	3 do palish to darkish crêpe, thick, 5s. 5½d. to 5s. 9½d.; 5 cases dark, 4s. 9d. to 4s. 11d.
B.R.R. Co., Ltd.	17 do fine palish to darkish amber sheet, 6s. 0½d. to 6s. 0¾d.; 8 cases same, 6s. 0¼d.; 8 cases palish to darkish mottled sheet, 6s.; 5 cases darkish pressed scrap, 5s. 1d.; 8 cases dark scrap, 4s. 6d.; 3 cases pressed Rambong scrap (red), 4s. 10½d.
W. P. M.	6 do fine amber sheet, 6s. 0¼d.

LONDON, June 22nd —At to-day's auction, 278 packages of Ceylon and Straits Settlements plantation grown rubber were under offer, of which only 92 changed hands in the room. The total weight amounted to about 15¼ tons, Ceylon contributing 3½ and Straits Settlements 11¾. The market has maintained the quiet tone recently ruling, and orders being scarce, few of the large buyers were inclined to operate to any great extent. As a result competition was restricted, and a large proportion of the offerings had to be retired for lack of support. Where sales were effected some concession had to be given on last prices, but for the most part sellers preferred to have recourse to the private market. Plantation biscuits and sheet to-day 5s. 9d. to 5s. 11d., same period last year, 6s. 5d. to 6s. 7¼d. Plantation scrap. 4s. 6d. to 5s., same period last year, 4s. 3½d. to 5s. 5¾d. Fine hard Para (South American) 5s. 2¼d., same period last year, 5s. 8d. Average price of Ceylon and Straits Settlements plantation rubber.—92 packages at 5s. 3¼d. per lb., against 123 packages at 5s. 8d. per lb. at last auction.

Particulars and prices as follows :—

CEYLON.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
Kumaradola	3 cases palish biscuits (damp), 5s. 7½d.
Tudugalla	3 do dark biscuits, 5d. 8½d.; 1 case good scrap, 4s. 3d.; 1 case loaded scrap, 2s. 6d.
M. (in diamond)	1 do very fine Ceara biscuits, 5s. 11d.; 2 cases little darker, 5s. 11d.
Doranakande	2 do fine palish to dark scrap, 5s.
Halwatura	2 do fine pale scrap, 4s. 10d.
Okanda	1 do loaded scrap, 2s. 2½d.
Katugastota	1 do very fine pale scrap, 5s.
Maddagedera	1 do good palish to darkish scrap, 4s. 11½d.

STRAITS SETTLEMENTS.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
C.M.R.E. Ltd.	2 cases darkish to dark, 5s. 2d.
V.R.Co.Ltd. Klang F.M.S. (in triangle)	42 do fine dark washed scored sheet, 5s. 9d. to 5s. 9½d.; 7 cases fine pressed palish crèpe, 5s. 4¼d. to 5s. 4½d.; 7 cases darkish to dark, 3s. 6d. to 4s.; 2 cases dark soft, 3s. 6d.
L. & P. F.M.S. K.	14 do fine pale ribbon, 5s. 11½d. bid for part.
S. R. C. Ltd.	9 do fine palish to darkish crêpe, 5s. 3¼d.
J. E. Ltd	4 do pressed scrap, part sold 3s. 6d.
S.C.	4 bags scrap, etc., 4s. 6d.

LONDON, July 6th.—At to-day's auction, 222 packages of Ceylon and Straits Settlements plantation grown rubber were under offer, of which only 22 changed hands in the room. The total weight amounted to about 10½ tons, Ceylon contributing 2¾ and Straits Settlements nearly 8. In sympathy with the Para market, demand was again weak for plantation grades, few orders being in evidence. In consequence, most of the offerings were retired for want of support, but where sales were effected, prices marked from about 1d. to 2d. per lb. decline on last rates for the finer qualities, and no business was done in scrap at the auction. Plantation fine to-day 5s. 8d. to 5s. 9¼d., same period last year, 6s. 3d. to 6s. 4½d. Plantation scrap value about 4s. 6d. to 5s., same period last year, 4s. 3½d. to 5s. 5½d. Fine hard Para (South American) 5s., same period last year, 5s. 6½d. Average price of Ceylon and Straits Settlements plantation rubber.—22 packages at 5s. 8d. per lb., against 92 packages at 5s. 3¼d per lb. at last auction.

Particulars and prices as follows :—

CEYLON.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
K. M. (in diamond)	1 case good Ceara biscuits, 5s. 6d. bid.
Culloden	8 do very fine pale biscuits, 5s. 8¼d. bid.

STRAITS SETTLEMENTS.

L. E. (Muar in triangle)	6 cases fine pale crêpe, 5s. 9d.
Semba	10 do fine pale crêpe, 5s. 9¼d. bid.
Highland	7 do fine palish to darkish crêpe, 5s. 5¾d.
P.R. S.B.	5 do fine amber sheet, 5s. 8¼d.
G.M. S.B.	4 do fine amber sheet, 5s. 8¼d.
Jebong	17 do fine large amber sheet, 5s. 8¼d. bid.

SHIPMENTS OF PLANTATION RUBBER.

Exports from Colombo and Galle from 1st January to 28th May.

1906	48 tons.	1904	12¼ tons.
1905	18 ,,	1903	8½ ,,

Exports from Singapore from 1st January to 15th May, 1906, 72 tons.

,, ,, ,, 1st four months 1906 ... ... 61½ ,,

,, ,, ,, 1st ,, ,, 1905 ... ... 5 ,,

GOW, WILSON & STANTON, LTD.

OILS AND FATS.

Lemongrass and Citronella in Ceylon.

By Ivor Etherington.

During the last three years the export of Ceylon citronella oil has gradually advanced in quantity, although the total export has not reached the figures of 1902, when 1,294,750 lbs. were shipped from Colombo and Galle. The total output for the last four years has been

1902	1,294,750 lbs.
1903	1,027,486 ,,
1904	1,133,068 ,,
1905	1,282,471 ,,

The chief purchasing countries are the United States, which leads easily, the United Kingdom, Germany and Australia. and 1905 exports to these countries were :—

U.S. America	601,706 lb.
United Kingdom	398,700 ,,
Germany	193,331 ,,
Australia	60,288 ,,

France took 11,925 lbs. and China 10,499 lbs.

Curiously enough there was a small export of 216 lbs. to the Straits Settlements. In this connection we may state that planters in the Malay Peninsula are turning their attention to lemongrass as a suitable catch crop for rubber plantations. Over there they seem more desirous of intercropping young rubber than Ceylon men as a rule are, and lemongrass answers requirements very well. But lately quite a number of Ceylon planters have been enquiring for roots of lemongrass for propagation purposes to try it as a catch crop in young rubber clearings.

It is useful as a catch crop as it gives the first harvest after six months, being propagated from cuttings. It has been found at Peradeniya that the lateral root system of *Hevea* rubber spreads one foot each year on the average ; that is a circle 2 feet in diameter round the tree is occupied the second year, one 3 feet in diameter the third year, and so on, so that in rubber planted 10 x 10 feet the root systems meet and occupy the ground in five years. Lemongrass can be grown down the rows between lines of rubber trees without interfering with the rubber roots, and as the plant dies down in three years, and has then to be freshly propagated for further growing and extensions, it is very suitable as an early catch crop in the plantation.

Interest has been aroused in lemongrass and citronella at one or two of the monthly meetings of the Ceylon Board of Agriculture, when papers on the subject have been read by Mr. Wright and Mr. Samaraweera. At Peradeniya further work has been done with lemongrass oil, and the results may be of importance.

Acting on suggestions thrown out by the London chemists, Messrs. Sage and Harrison, Mr. Herbert Wright has been preparing lemongrass and citronella oil according to their requirements. Samples of these oils will be prepared, as stated recently before the Board of Agriculture, and sent to London, each sample bearing a label stating the guaranteed percentage of essential ingredients—citral, geraniol, and citronellal—and their physical properties. The oils have been subjected at the Experiment Station to refining processes. The refined oil is of an exceeding pale yellow green colour, and never partakes of that deep claret-like colour of the crude oil. Samples of this refined oil were exhibited at the recent show of the Colombo Agri-Horticultural Society side by side with unrefined lemongrass oil for purposes of comparison.

The refining process gives a remarkable residue, a dark resinous mass which has a low melting point. This material on cooling when exposed to the air solidifies. Just prior to solidifying it is very sticky; and in the unrefined oil existed in a state of solution. What the value of this residue is, and to what uses it may be put, Mr. Wright is as yet unable to say. The oil when the manufacturers refine it must leave some such residue, and it will be of interest to learn what economic use is made of it.

Refining of the oils has in some cases resulted in a loss of 20—30 per cent in weight. As pointed out at a recent meeting of the Board of Agriculture, 8*d.* per oz. was obtained for unrefined lemongrass oil, so that to make the refining process a paying one, something near one shilling per oz. will be required as the price. It will have to be ascertained what the London and New York buyers are willing to pay for the refined oil before its worth can be stated, and whether the refining process will be worth the extra labour, etc.

Lemongrass cultivation is spreading in Ceylon and Malaya. At present the acreage under it is very small, but plants are being distributed every week to parts of Ceylon, especially the Southern Province, and to the Straits and India. A rival to lemongrass has recently appeared, and may become a serious competitor. This plant is the *Backhousia citriodora*, a myrtle-like shrub with fragrant foliage which grows plentifully in Queensland. Its oil is stated to contain 93½ per cent. of citral, against 70—80 per cent. in lemongrass. Gildmeister and Hoffmann state that *Backhousia* oil "appears to consist almost entirely of citral." The Imperial Institute analysed samples and valued the oil commercially at 7*d* per oz. c.i.f. London, and by another London authority it was valued at 9*d.* to 9½*d.* per oz. in London. It remains to be seen if the plant can be commercially worked; with Australia's present labour policy it is unlikely that this essential oil product can be profitably worked any more than profitable cultivation on any large scale can be carried on of rubber, cotton or coffee.

LEMONGRASS OIL.

IN JAVA AND CEYLON.

It would appear that Java will in the immediate future make competition to the Cochin distillate. Samples have already been approved many a long day since, and the first consignments may possibly make their appearance very soon. Since in the oil of *Backhousia citriodora* a new and very rich source of citral has also been discovered, which it may soon be possible to make use of in practice, the time for the exaggerated prices of lemongrass oil appears to be now past, and producers will do well to meet the trade with concessions.

A lemongrass oil originating from Ceylon examined by Sage which had been distilled at the Government Experiment Station at Peradeniya, had the following properties:—d15,5° 0.899, _D—O, 2°, citral-content 66,5%. In alcohol the oil dissolves badly, it only forms a clear solution with 1 vol. absolute alcohol, which, however, becomes cloudy when more solvent is added.

The oil shares this deficient solubility with the West Indian and African distillates which have frequently been referred to in these Reports. Both on account of the inferior solubility, and of the low citral-content, the oil must be characterised, in spite of the opposite view held by Mr. Sage, as an inferior product which cannot compete with a good East Indian commercial oil.—*Semi-Annual Report of Schimmel & Co.*

CEYLON CITRONELLA OIL.

EXPORTS FOR 1905: REPORT ON A PERADENIYA SAMPLE.

This important article has undergone fairly large improvements during the last six months, and it would appear to us as if it had acquired now, more than before, the character of an object for speculation, for the fact that the production has not fallen off is proved by the high figures of the export-statistics which closely approach those of the year 1902, but greatly exceed those of the last two years.

The shipments in 1905 from Colombo and Galle were:—

To the United States of America	601,706 lbs.
,, ,, United Kingdom	398,700 ,,
,, Germany	193,331 ,,
,, Australia	60,288 ,,
,, France	11,925 ,,
,, China	10,499 ,,
,, India	3,645 ,,
,, Belgium	2,161 ,,
,, the Straits Settlements...	216 ,,

as against:

Total in	1905 ...	1,282,471 lbs.
,,	1904 ...	1,143,068 ,,
,,	1903 ...	1,027,486 ,,
,,	1902 ...	1,294,750 ,,

On the other hand, the January shipments of a total of only 19,618 lbs. show such an enormous falling off, as compared with a monthly average export of about 100,000 lbs., that this fact appears to explain completely the lack of available goods and the high price of the same. It is only natural that this should influence forward deliveries, and the general situation will probably not become normal again until supply and demand have adjusted themselves to some extent. As already indicated above, speculators have agravated the situation by buying up the available stock in Europe, a step which could be carried out with a small amount of capital in view of the comparatively small quantities of oil.

In Ceylon, the distilling already came to an end in December, and as all the labourers are employed in the rice-fields in January, the work on the citronella grass-fields came for the time being completely to an end. Stocks are already cleared out, oil for early delivery is all contracted for, so that only later deliveries come under consideration. It is therefore possible that the position may become even more acute, and that the adjustment between supply and demand will only take place when stocks have again accumulated in the principal consuming countries.

We have been able, by placing our contracts in good time, to supply our clients fully, and we have also contracts running for April shipment which are shortly due.

Under these circumstances it is for the present out of the question that prices will go back, much less that the values formerly considered normal will again be reached.

C. E. Sage reports on a Ceylon citronella oil distilled at the Experiment Station established by Government at Peradeniya.

The examination of the dark orange-coloured oil gave the following results: $d_{15,5^\circ}$ 0,884, α_D—3,3° citronellal 36%, geraniol 41%; Schimmel's test: the oil gives with 80 per cent. alcohol only a cloudy solution. This inferior solubility of a guaranteed pure oil, induces Sage to attack Schimmel's test which, as is well known, consists of this, that citronella oil must form a clear solution with

1 to 2 vol. 80 per cent. alcohol at +20°, remaining clear or showing at most feeble opalescence when up to 10 vol. solvent are added, from which even on prolonged standing no drops of oil must separate off. Sage designates this test an arbitrary determination, which no doubt may be useful in some cases, but which cannot give information on the quality of the oil; for the latter, only the content of geraniol and citronellal are decisive. For this reason it does not appear desirable, according to Sage, to retain Schimmel's test as a criterion for the purity of the oils.

In reply to this we would point out that we also have always supported and still support the view that for the quality of citronella oil the content of total geraniol (geraniol + citronellal) is above all decisive. But such determinations frequently take up too much time for commercial practice, and for this reason an easy and quickly completed method of testing was desirable, which should at least give general data as to the quality of the oils. Such a method Schimmel's test has proved to be; experience has shown that oils can be tested by it with good results, and it has been thoroughly acknowledged and recommended by leading experts. Mr. Sage's protest will affect it all the less, as the oil examined by him also differs so widely in its specific gravity and content of geraniol + citronellal from commercial Ceylon citronella oil, that a comparison with the latter appears out of place. To what cause these differences must be attributed is a matter which cannot be settled without further inquiry. What calls for particular attention is the fact that in spite of its high content of geraniol + citronellal (77%) the oil dissolves so badly. In the numerous commercial oils examined by us, we have always observed that the solubility of citronella oils increases with the content of total geraniol, and that consequently the solubility is most intimately related to the quality of the commercial oils. This fact has even induced us to introduce a "raised Schimmel's test," according to which citronella oil mixed with 5% Russian petroleum must show approximately the same solubility in 80 per cent alcohol as the original oil. We have in no single instance observed that oils of superior quality have not stood this test, and we can with full confidence recommend it to every one interested in the honest trade in Ceylon citronella oil, notwithstanding the opposite view taken by Mr. Sage. We hoped that in this way it may be accomplished that in course of time only the best quality Ceylon citronella oil is placed on the market.—*Semi-Annual Report of Schimmel & Co.*

EDIBLE PRODUCTS.

Cacao Cultivation in Ceylon. II.

By Herbert Wright.

(Illustrated.)

General Characteristics of Varieties.

We shall first briefly outline the general characters of the numerous varieties of cacao grown in Ceylon and other countries and see what features can be relied upon as indicating the value of the different forms of cacao. It has been shown, when dealing with the history of cacao in Ceylon, that most of our seed supplies have been obtained from Trinidad, and the systems of classification drawn up by Morris and Hart for the identification of the varieties in that island are, in most features, applicable to Ceylon. These classifications do not, however, apply to all the varieties at present recognised in Ceylon, Java, Surinam, etc., and according to Preuss do not always strictly apply to the cacao in Trinidad itself; in several countries it has become customary to attach the name of the country to the variety of cacao exported, hence we learn of the Trinitario, Java-Criollo,* Java-Porcelaine, Nicaragua-Criollo, Surinam-cacao, Brussel-cacao, Moderboorn etc., and a classification or key to the varieties is required for separate countries. The following are the systems drawn up by Morris and Hart and the characters of the varieties in Ceylon as described by Lock †:—

Morris.	Hart.	Lock. Key to varieties. All the varieties here mentioned include both red and yellow sub-varieties as well as many other minor types :—
I.—Cacao Criollo ..	Class I. Criollo, or fine thin skinned. ..	Beans plump, majority white or pale in section; Shell soft and relatively thin I. Criollo.
	1. Var. a. Amarillo ..	Beans very large, somewhat flattened *a.* Nicaragua.
	2. ,, b. Colorado ..	Beans half as large as 1, more rounded. *b.* Old Red.
II.—Cacao Forastero ..	Class II. Forastero, or thick skinned cacao. ..	Majority of beans purple in colour, shell relatively hard and thick. II. Forastero.
(*a*) Cundeamor verrugosa amarillo (yellow). ..	Var. *a.* Cundeamor verrugosa amarillo. ...	Pods acuminate and "bottle-necked," rough, beans of high quality, pale and rounded. *a.* Cundeamor.
(*b*) Cundeamor verrugosa colorado (red). ...	,, *b.* Cundeamor verrugosa colorado ..	
(*c*) Liso amarillo ..	,, *c.* Ordinary amarillo. ..	Pods various, usually not "bottle necked"; beans of fair to good quality. *b.* Liso
(*d*) Liso colorado ..	,, *d.* ,, colorado. ..	
(*e*) Amelonado amarillo..	,, *e.* Amelonado amarillo. ...	Pods ovate, nearly smooth, usually "bottle-necked"; beans of lower quality, usually flat and all purple. *c.* Amelanado.
(*f*) Amelonado colorado	,, *f.* ,, colorado. ..	
	Class. III Calabacillo, or small podded, thick smooth-skinned, flat-beaned.	Pods ovate smooth, small, not "bottle-necked"; beans small, flat, and all deep purple. *d.* Calabacillo.
(*g*) Calabacillo amarilla	Var. *a.* Amarillo. ...	
(*h*) Calabacil.o colorado	,, *b* Colorado. ..	

* Mededeelingen omtrent de op Java aangeplante Cacaovarieteiten; L. Zehntner, Proefstation voor Cacao to Salatiga, 1905.

† Varieties of cacao in Ceylon, Circular, R.B.G., Vol. 2.. No. 24, 1904.

Photo by Ivor Etherington.

THE NICARAGUAN TYPE OF CACAO.

Photo by Ivor Etherington.

TYPICAL AMELONADO CACAO.

FRUIT CHARACTERS.

Most of the varieties of cacao grown in Ceylon are roughly divisible into the Old Red or Caracas, the Forastero or Hybrid and the Amelonado types. The classification given by Morris is simple, and that by Hart more detailed, though the latter does not, in my opinion, give a sufficiently minute sub-division to make it of every-day use on cacao estates outside Trinidad. The ease with which new strains of cacao arise has resulted in confusion, and it is a very difficult task to formulate a key to include the distinctive characteristics of the varieties existing in any one country where cacao has been cultivated for twenty or thirty years. As far as fruit characters alone are concerned it would be no difficult matter to collect specimens which in point of size, shape, and colour form a more or less continuous series connecting the Nicaragua, Criollo, and Forastero types with one another; even the same tree in a single year or in successive years may produce fruits differing widely in external characteristics, and when one considers the characters of the rest of the vegetative system and those of the seeds, the mixed nature ol the varieties now cultivated is manifest.

The classification of the cacao varieties into three groups by Hart is, according to that gentleman, necessary, in order to distinguish between the Calabacillo and Forastero types. It is equally necessary to adopt a similar classification for the varieties in Ceylon and to perhaps omit the Calabacillo group (which is very rarely if ever, met with in this island) and give the Amelonado variety a separate class, as it is on all estates so markedly different in its shape, green-yellow colour and flat purple seeds from any other Forastero type.

In order to enable one to select the various types it will be necessary to deal very fully with the characters of the fruit wall and seeds.

FRUIT WALL.

Thickness.—The thinnest walls are found in the Nicaraguan and Caracas types and the thickest in the Forastero forms. The following figures show the thickness, lengths, circumferences and weights of several fruit walls of cacao pods grown at Peradeniya:—

Variety.	Thickness of wall.	Length of wall.	Circumference in middle of fruit.	Average weight of 100 fresh fruit walls. lb.	oz.
Nicaragua	12 mm.	19·1 cm.	28·0 cm.		
Caracas	13 ,,	17·2 ,,	23·7 ,,	48	4
Forastero-Cundeamor ..	15 ,,	20·6 ,,	26·5 ,,	84	14
Amelonado	15 ,,	18·5 ,,	26·7 ,,	74	12

It is obvious from these records that the most wasteful variety of cacao, as far as the thickness and weight of fruit wall are concerned, is the Forastero-Cundeamor and the most economical the Caracas or Nicaraguan type.

Colour.—The outer surface of the fruit wall is, in unripe specimens, red or green, these changing during ripening to reddish-yellow or yellow respectively. In the Forastero group the fruits show all proportions of red and green inter-mingled with one another and even the Criollo fruits may be yellow or red. In Ceylon, the Amelonado variety is distinct in always having a green wall changing to pale yellow on ripening. Usually all the fruits on the same tree have a similar colour or distribution of colours.

In Trinidad, as indicated by the classifications of Morris and Hart, each variety is subdivided into red and yellow forms, and the same applies generally to the varieties in other cacao-growing countries.

COLOUR OF OUTER SURFACE OF FRUIT WALL.

Variety.	When Unripe.	When Ripe.
Caracas ...	Usually red; frequently green.	Usually reddish-yellow; frequently yellow.
Nicaragua ...	Red or green.	Reddish-yellow or yellow.
Cundeamor ...	Red and green.	Reddish-yellow.
Amelonado ...	Green.	Yellow.
Calabacillo ...	Usually red.	Usually reddish-yellow.

Shape and size.—In shape and size there is every variation between the long pod with acuminate apex—as in some forms of Nicaragua and Cundeamor,—to the short, ovate, broad base and blunt apex of Amelonado. Some forms are constricted at the base—Cundeamor and Liso—others are wide at the base—Sambito and Amelonado—and others intermediate between these.

(*To be continued.*)

REPORT ON COCOA AND COLA INDUSTRIES IN THE GOLD COAST.

INTRODUCTORY NOTE.—Doctor Gruner, District Commissioner, Togoland, West Africa, visited the Gold Coast in August 1903 on behalf of the German Agricultural Committee, by permission of the Governor of the Gold Coast, for the purpose of acquiring information relative to the cocoa and cola industries in that Colony. The report on his visit, written in German, appeared in the August, September and October, 1904, numbers of "Der Tropenpflanzer" and the following remarks are a precis of this report compiled by W. H. Johnson, Director of Agriculture, Gold Coast Colony, West Africa.

I. TOUR IN THE COCOA AND COLA DISTRICTS.

During the first two hours march after leaving Aburi few cocoa trees were seen but they were much more numerous during the 3rd hour's march, at the end of which Apasare was reached. This town is pleasantly situated between wooded hills and surrounded by cocoa plantations.

The natural sources of rubber in Akwapem have been destroyed and many farmers have now commenced to cultivate plants distributed from the Aburi Botanic Gardens. Previous to the cultivation of cocoa the oil palm was carefully looked after in this district and oil prepared from its fruits for export, but now only sufficient is manufactured for culinary purposes.

Along the road from Apasare to Akroase, a distance of about ten miles, cocoa plantations intermixed with oil palms were very abundant, the time taken to cover the distance between the end of one plantation and the beginning of the next not exceeding five minutes in any one instance. One enterprising native planter at Akroase had planted 5,000 cocoa trees as well as several hundred rubber trees. Practically the whole five miles of road between Akroase and Kofrodua runs through cocoa farms, but in the new Juaben districts, of which Kofrodua is the capital, they were not so numerous.

Photo by Ivor Etherington.

TYPICAL FORASTERO CACAO

A few years ago coffee was largely cultivated in Akim; this has now been abandoned, and cocoa farms, principally of young trees, and cocoa drying platforms were seen all along the route. Carriers conveying cocoa were even met coming from Okwawu where this cultivation has also extended.

Cola trees were first observed at Tafu, and occured at intervals until Kwâben was reached, their distribution being similar to the unplanted oil-palms, in some instances numerous, in others scarce. Those growing in the forest had long slender trunks whereas those found in cleared areas were sturdy branching trees. Occasionally cocoa was observed planted around the cola trees, appearing as though the latter had been planted as shade for the former. Numerous natives from German Togoland were met with in the cocoa districts, some stated they had been working in the cocoa plantations as hired labourers for several years and understood the cultivation of this product; they expressed their willingness to return to their homes and start cocoa plantations provided they were confident of the support of the German Government, and assurance of this support was given them.

II. Cocoa Cultivation by the Natives.

The usual native method of establishing a cocoa farm is as follows:—The bush is cut down and burnt, only surface roots and weeds are cleared away and yams are then planted, cocoa not being planted until the yams have been harvested. In the case of large plantations the clearing and weeding is carried out by hired Togo or Krobo labourers who are paid 20*s*. per acre for each of the following works, viz:—cutting down bush, felling trees, and clearing. For succeeding weedings which occur quarterly, 10s. per acre is paid, but sowing and planting is done by the owner. Cocoa is principally propagated by seeds which are either sown thickly in seed-beds prepared in moist situations, often by the side of a brook, or directly out in the plantation, two in each hole, when if both germinate the weaker is cut away.

The reason given for this latter method being that the plants transferred from the seed-beds die if a period of dry weather follows their trans-planting, for neither the seeds nor plants are watered; but this is seldom necessary as this operation takes place during the two rainy seasons (March—June and September—October.) Each land-owner has from 3,000 to 4,000 trees and some are said to have as may as 10,000, while every school boy has his own cocoa farm which he tends himself. The trees in many plantations are planted closely together, usually only 8 or 9 feet apart, but the owners of old plantations have observed that when trees are planted in this manner, the branches interlace and the yield decreases; consequently in new farms the trees are being planted at from 11 to 12 feet apart.

Tania is cultivated between the cocoa, but shade trees are not planted although when the forest is cleared economic trees such as Funtumia rubber, oil-palms, and cola are left standing and slight shade is unintentionally provided. Small farms do not usually require shade trees as they are generally situated near the edge of the forest which furnishes shade during a great part of the day, and while the cocoa is young it receives shade from the tania. Little attention is given to the young plantation beyond just clearing away weeds immediately around the plants, and cutting away suckers. No steps are taken to destroy pests; the borer is the only one which has proved really troublesome and this is present in nearly every plantation. Farmers have been cautioned to exterminate it by the Botanic Department and by printed notices, but with no visible result. The amount of cocoa produced is not appreciably affected by its attacks because of the large number of new trees planted.

III. Mode of Preparing Cocoa for Market.

The old plan of preparing the beans for market by simply drying them in the sun has been abandoned everywhere in favour of the fermenting method introduced by the Government Botanic Department. The beans are placed in heaps upon mats and then covered up with mats weighed down with stones, and left for four days if this takes place upon the same day the pods are plucked, but for three days if upon the following day; after which they are washed in baskets.

In order to facilitate the latter operation fermentation takes place on that portion of the farm nearest a brook. Washing completed, the cocoa is taken home to be dried in the sun either upon specially built wooden platforms or mats made of plaited palm leaves. Properly fermented cocoa tastes sweet, is mahogany colour inside, and the outside shell is a clear light red.

IV. Reasons for the Depreciation in the Market Value of Cocoa.

The native farmers consider they are being cheated when prices fall, and complained bitterly with regard to the prices paid by the merchants for their cocoa; they had even petitioned Government in this matter, who learned from inquiries addressed to the merchants that this was due to the falling off in the quality of cocoa, and printed notices were distributed by Government warning the planters to take more pains in the preparation of this product. In reply the farmers accused the middlemen of mixing good and bad cocoa, and suggested this as a reason for the deterioration. The advances made by the merchants to farmers is one of the causes for the depreciation of cocoa; previous to or at the beginning of the cocoa harvest cash is advanced which the receiver binds himself to pay back in cocoa, and when pressed to fulfil his contract he either buys or borrows cocoa, irrespective of quality, to furnish the promised supply. This pernicious system, although not so much in vogue as hitherto, both encourages the native to get into debt and to adulterate his produce. Another cause is the method of transport; cocoa is placed in casks and rolled from the principle buying centres to the port of shipment, dust gets into the cask and renders it unsightly.

V. The Cola Industry.

The cola tree is very seldom planted and the tending of those trees produced by natural agency is limited to the clearing away of bush and weeds; but every such tree has an owner, who claims this right in virtue of having affected the first clearing. Cola trees raised from seed commence to fruit when 6 or 7 years old; the produce is small at this period but increases yearly until the tree is mature when it will yield from 40 to 50 fruits.

Two crops are produced annually, in December and April, of which the former is the principal. Fruits which fall off the trees are not collected as they spoil rapidly; those plucked from the trees are stored in the shade as the hot sun turns them black. When the nuts are freshly gathered some difficulty is experienced in skinning them, but if they are stored for a short time the skin can be readily removed with the fingers. If the nuts harvested exceed the demand the surplus is skinned and packed with the leaves of a particular plant (*Thaumatococcus Danielli*, Benth ;) in broad baskets made of palm leaves and stored.

The Hausas, who are the principal consumers, convey salt to the cola districts and barter it for cola; 1 lb. of salt valued at 6*d.* being exchanged for 100 cola nuts. The price of cola, in the districts where it is produced, fluctuates between 3*d.* and 1*s.* per 100 nuts, but in Accra cost of transport raises it to 1*s.* 6*d.* per 100. Cola is principally exported by sea to Lagos; the value of the exports in 1900 and 1901 were £43,133 and £35,024 respectively; while the estimated annual value of the exports overland to the hinterland is £75,000. The principal cola markets in Akim are Insuaim, Essamang, Kwaben, Tumfa, and Kaukan. In Kwaben or Tumfa, it is possible to purchase from a single person 10 loads containing 2,000 nuts each. Previously the cola produced in Ashanti was only purchased by Hausas and transported by them northwards to the Hausa States, but the restoration of order in Ashanti and the completion of the railway to Kumasi has facilitated the transport of this crop to the coast.

VI. The Botanic Gardens, Aburi—and the Development of the Cocoa Industry.

The Agricultural Experiment Gardens formed at Aburi in 1890 conducted cultural experiments with cocoa in order to draw the attention of the natives and especially the chiefs to the advantages likely to accrue from the cultivation of this product. The oldest trees in the Gardens are 15 to 16 years old (*i.e.* in August 1903), and a large area is planted with trees 12 to 16 years old. This healthy and productive plantation is the origin of the great cocoa industry of the Gold Coast as the fruits produced by it have been continuously distributed to the natives. The trees are planted (I) 12 × 12 feet apart, and the first shade trees employed were *Erythrina*; but as this tree is deciduous during the dry season and therefore of little value a more satisfactory substitute (II) has been found.

In 1898 the Curator commenced travelling in the neighbouring districts with the view of instructing the native farmers in the cultivation and preparation of cocoa. During each of his tours large quantities of cocoa seeds were offered to the natives without charge; many were, however, loath to accept them being suspicious of the objects for which this free distribution was being effected; but when the seeds were offered for sale at a ridiculously low price they were eagerly purchased. The following year the same officer prepared a brief treatise on the cultivation and preparation of cocoa which was first printed in English and later in the vernacular for free distribution. Opportunities were also afforded to the chiefs and other influential natives to send one of their family to the Gardens to learn agricultural work, but this excellent arrangement met with little success as the parents and guardians in each case failed in their compact to supply their protege with subsistence money. A second attempt which consists of receiving young lads who have received a slight education as paid agricultural apprentices, has proved more successful; again from the regular labourers in the Gardens, some are selected to teach native farmers and others are employed to lay out their cocoa plantations.

When cocoa was first produced the merchants were disinclined to purchase this product and the Botanic Gardens undertook its shipment, but naturally abandoned this work when the merchants had overcome their first reserve. The development of the industry is still, however, kept in view and experiments are now progressing in the fermentation of cocoa.

VII. Further Development of Cocoa Cultivation.

In order to encourage cocoa growing in the Western portion of the Colony, the Government has established an experimental garden at Tarkwa where experiments are in progress with the cultivation of this product with a view to determine the best distances to plant the cocoa trees apart and the most suitable shade trees. Large quantities of seed are being sent from Aburi for distribution in Ashanti, and the Basel Mission Society is also encouraging its members to form cocoa plantations in the latter district.

There is little doubt that the export of cocoa will considerably increase within the next few years, for thanks to the sporadical method of laying out cocoa farms previously described, neither epidemics nor exhaustion of the soil will effect it, and nothing but a further heavy fall in prices will check it. In short here is an industry developed which one can only admire and regret that Togoland lacks such a beneficial institution.

THE OLDEST TEA IN CEYLON.

It is our custom annually to record the condition and progress of the oldest regularly cultivated tea field in Ceylon—that of 20 acres on Loolecondera planted by Mr. James Taylor (for Messrs. Harrison and Leake of Keir Dundas & Co.) in 1868-9. Mr. G. F. Deane, who has been Manager now for 14 years and has courteously informed us at intervals as to its condition, wrote us as follows on July 7th (a letter which was lost in the post—but of which he has sent us a copy dated July 14th) as follows :—

"In reply to your enquiry as to the condition of the old tea on Loolecondera, the oldest field, some 20 acres planted in 1868-9 Assam-Hybrid and which is very wind-blown and has never been manured, has given last season a yield of 536 lb. made tea per acre in the 37th or 38th year from planting, and has averaged over 400 lb. made tea per acre for last six years.

"The next older field planted in 1875 (84 acres), also wind-blown and never manured, gave 428 lb. made tea per acre last year. Both fields are looking well and the China tea planted out along the roadside in 1866 is still flourishing."

The yield of 536 lb. made tea is particularly good—considering that last year we recorded the fact that after the last pruning in 1901 the yield had ranged from 350 only up to 425 lb. We congratulate Mr. Deane on the result.—*Ceylon Observer.*

THE LEADING TEAS OF THE WORLD.

India.

The remarkable revolution which has taken place in the source of the tea supply of the world may be gathered from the fact that, in dealing with the tea-producing countries, there is no hesitation in placing British-grown teas first on the list. Fifty years ago, "tea" and "China" were almost synonymous terms ; to-day, tea is a cosmopolitan product obtained from a variety of countries each of which is predominant in its own particular market. Moreover, it is beyond doubt that China tea is on the down grade, while that of British India continues to make the most extraordinary advance, its exports having trebled during the last twenty years. In the same period, the exports of Ceylon tea have expanded from two to a hundred and fifty million pounds a year ; and there has been a heavy increase in the exports of Japan and Java. These developments will be more easily grasped by a reference to the following tabulated list of the exports of tea from the latest official statistics :—

Exports of Tea From the Principle Tea-Producing Countries of the World, in 1884 and 1904.

Country.	1884 Lbs. Exported.	1904 Lbs. Exported.
British India	60,473,000	213,808,000
Ceylon	2,393,000	149,227,000
Total British-grown tea	62,866,000	363,035,000
China	268,800,000	193,466,000
Japan	35,716,000	67,162,000
Java	5,575,000	21,287,000

From these figures it will be readily seen that the exports of British-grown Indian and Ceylon teas to the markets of the world are not far from double those of China. Whereas twenty years ago they did not export a quarter of the amount sent out from Flowery Land.

Although the countries scheduled are the principal tea producing ones, there are others where the plant is cultivated, for, contrary to the general impression, tea can be grown almost anywhere under temperate or tropical climatic conditions. I myself have grown tea in the Himalaya mountains at an altidude of over 6,000 feet over sea level—and seen it buried yearly under two feet of snow! It is the growing of tea profitably that is "another pair of shoes." Apart from the countries named, tea is grown in Burmah, the Andaman Islands, Natal (where they turn out nearly two million pounds annually), Central Africa, Fiji, the Kabbaz (Caucasus), Jamaica, (experimentally) the Southern States of America—all with commercial intention; and there are countless other places where it exists experimentally, in the botanical gardens, and so forth. But for the profitable production of tea, there must be a forcing climate, with ample rainfall, and an abundant supply of cheap labour for gathering the harvest, or "plucking" the leaf as it is technically called. In the most favoured districts, where the "flushes" of leaf are thickest, the outside average capacity of a labourer will not supply daily more leaf than can make 5 pounds of tea; and in less-favoured districts, the most skilful and diligent hand will fail to obtain even half that amount, and this at two cents a pound (which is the recognized scale of payment for the work), imposes a limitation that cannot be overcome except in those particular countries where tea is grown at present. On these economic grounds, the production of tea must remain the monopoly of the Far East, where labour and living are cheap; and the rainfall of regular "monsoons" supply those climatic conditions which are necessary to a luxuriant growth of leaf.

It is estimated that the amount of tea available for export from the tea-producing countries is 600,000,000 pounds. How much tea remains in the countries of production it is impossible to say, owing to the entire absence of any Chinese statistics on this point. It is, however, a curious fact that, except in China and Japan, the consumption of tea in the countries of their production is extremely small, and may almost be said to be a negligible quantity. The crops of India, Ceylon and Java are grown purely for export, the general population of those countries being too poor to afford tea. Of the six hundred million pounds exported from the countries of production, five-twelfths is taken by Great Britain, whose total consumption equals that of all the other European countries and the United States put together. The five-principal tea-consuming countries in the world, and the amount they consumed in 1903, are given as follows:—

Country.	Lbs. Imported.	Consumption Per Head.
		Lbs. oz.
United Kingdom	255,498,000	6.03
Russia	132,264,000	0.94
United States...	104,632,000	1.30
Australasia (1901)	28,380,000	7.05
Canada	23,969,000	4.34

The Cape of Good Hope and Holland are the only other countries where there is a substantial per capita consumption, and thus, excluding China and Japan, the tea-drinking communities of the world may be reckoned as consisting of the above seven.

The fact that stands out from these figures is that the English are the greatest tea consumers of the civilized world, and it may therefore be interesting to see what teas they prefer. Since the introduction of India tea fifty years ago and of Ceylon tea twenty-five years later, they have practically discarded the use of the China herb. It may be urged that this only shows natural preference for the product of their own empire, but against this fact there remains the solid argument that British-grown teas are far more expensive than China teas, and have won their way into the market on their merits. Imperialism may explain a sudden quixotic action, but that sentiment has no room in weekly domestic bills; and the conversion of the tea-drinking Englishman from the China to the Indian and Ceylon herb, at an extra expense to his pocket, has resulted from economic conviction that he is getting the best value for his money. Therefore, not merely on the grounds that the exports of the British-grown teas are the largest, but also because the article is the best, do I place it first on the list.

The secret of the superiority of Indian and Ceylon teas is very simple—they are made from a better variety of plant than the China teas, and one producing a leaf with better "liquoring" qualities. Assam is the home of the tea plant; and it was from its steaming valleys ages ago that the seed was taken to China. In the process of centuries from change of soil and climate and other causes, the plant deteriorated. Compared to the indigenous variety in Assam, the modern China-tea-bush is as a wild strawberry to a cultivated one. By the irony of circumstances when the Government of India first started the cultivation of tea, it sent to China for tea seeds and seedlings! All the earlier tea plantations in India were planted out with the China variety, and they proved a terrible handicap to the industry. I, myself, was in charge of an old Government plantation for many years, and no one knows better the hopelessness of trying to make "quality" from the miserable af at my disposal; and as I manufactured some five million pounds of it, I may claim to speak with experience. It was not until I rooted out the old "China" bushes, and replanted the area with seed obtained from Assam—as has been done all over India, where the original China-plant gardens may be said to have been eradicted, that I was able to line up my tea with those for which India had acquired its reputation. Ceylon, starting later in the race, was able to avoid this fatal initial error, and all its plantations are laid down with the Assam variety. But perhaps the greatest tribute to the superiority of the India plant was paid by Java, when the Dutch tea planters there imported seed from Assam, with the result that the production of that island has gone right ahead, and is taking its place side by side with that of India and Ceylon. Such is the real explanation of the superiority of Indian and Ceylon teas—they are made from an altogether superior variety of plant.

With these preliminary observations, I will turn now to more detailed examination of the tea districts of India, which are far more widely scattered than many readers may be aware of. The great bulk of cultivation clusters around Assam, which lies to the north-east of Calcutta, but the cosmopolitan nature of the industry in India—which is a cosmopolitan country, peopled with many races of men—may be gathered from the fact that tea is grown in Kasmir, two thousand miles to the west of Assam, and in Travancore, which is nearly two thousand miles to the south. Moreover, there are several districts between these extremes, as the following list of them will show:—

THE TEA DISTRICTS OF INDIA.

1. Assam.
2. Kachar.
3. Sylhet.
4. Darjilling.
5. Doars.
6. The Terai.
7. Chitagong.
8. Chota Nagpor.
9. Kangra Valley.
10. Dehra Doon.
11. Kumaon.
12. The Nilghiris.
13. Travancore.
14. The Wynaad.

There are also plantations at Simla, Loharduga and in Kashmir.

Of the above districts, the first three may be regarded as the principal home of the tea plant. Assam is situated in the Bramaputra Valley, while Kachar and Sylhet belong to the district known as the Surma Valley. They lie on the north eastern boundaries of India, being divided from Burma by a belt of native states peopled by aborigines.

Darjilling, Doars and the Terai lie considerably nearer to and almost due north of Calcutta, while Chitagong is near the sea coast to the south-east of that city. Chota-Nagpur, which is the driest and least prosperous district, is situated in the centre of Bengal, and so far from the Himalayas that it is not blessed with the heavy rainfall that is poured over the other districts.

The Kangra Valley, Dehra Doon and Kumaon are three small districts lying on the slopes of the Himalaya Mountains, on the north-western extremity of India. They were three of the localities originally selected by the Government of India as particularly suitable for the cultivation of tea, when the idea was held that the steeper the ground the better the plant—one long since exploded.

The Nilghiris, Travancore and the Wynaad are all in the southern part of the peninsula; the latter two places enjoy a climate very like that of Ceylon. They are the latest districts opened out in India, and were there any prospects for the further expansion of cultivation, they could supply countless acres of the richest forest land.

The tea plantation in Kashmir belongs to the Maharaja of the Province, and was started about the same time as he established vineyards for the production of wine; but the exquisite climate of the land of Lalla-Rookh is not suitable for the profitable cultivation of tea.—*Herbert Compton in Tea & Coffee Journal, New York.*

CEYLON'S IMPORT DUTY ON INDIAN TEA.

For some time past the Ceylon papers have made mysterious references to a Despatch from the Secretary of State for the Colonies regarding Ceylon's import duty on Indian tea. Our readers know that the Calcutta I. T. A. have transferred the matter to the London Committee to bring pressure to bear on the authorities at that end. The Despatch to the Ceylon Government, however, is now published, and is as follows:—"I would be glad to know whether your Government remains of the same opinion as a year ago, and still considers that the present restriction should not be relaxed, or whether the conditions of the case have been altered in any way. As I understand, the object of maintaining the duty is to safeguard the purity of Ceylon tea, and the Ceylon tea growers seem to think that the encouragement to the blending of Indian and Ceylon teas, which would be the result of removing or modifying the present restrictions, might benefit India at the expense of Ceylon, although some additional trade would be attracted to Colombo. It is a matter on which local opinion must prevail, no Imperial interest being involved; but the present policy seems to be of somewhat doubtful value, and you may be of opinion that the time has come to reconsider it." The Governor of Ceylon, in forwarding the Despatch to the Planters' Association, takes a very broad and statesman-like view of the question. He says: "The object of the Ceylon Planters is, it is understood, to ensure that no tea other than that grown in Ceylon is exported from the Colony as pure Ceylon tea, and in this desire His Excellency considers that the planters are justified. But His Excellency regards it as worthy of the condsideration of the tea producers whether the object referred to could not be secured without prohibiting the blending of tea in Colombo in bond. Colombo is the natural centre of the world for tea blending, and if precaution be taken that all tea leaving the bonded stores is marked as blended tea in unmistakable manner, it is not clear how the Ceylon grower can be injured. If Java or China teas are required for the market, they will go to Europe to be blended there as easily as they could be sent to Colombo, and in preventing the blending of tea here in bond the Ceylon growers seem to prevent the creation of an additional market, while Colombo is losing what would probably be a lucrative business."

The Planters' Association, however, seems to be impervious to all arguments, and in its reply to the foregoing letter, makes the following rather lame enquiry: "The majority of both bodies are of the opinion that the advantage to be gained by allowing the blending of all teas in Colombo is problematical, and the possibility of damage to the producers' interest probable. What precautions are the Government of Ceylon prepared to adopt to prevent inferior teas being imported for blending purposes, and what precautions to prevent blends being exported from Ceylon as pure Ceylon tea? This, in the opinion of my Committee, would entail the establishment of a new department." The *Ceylon Observer*, as the oldest and most representative journal in Ceylon, is of Sir Henry Blake's opinions. Our contemporary has grasped the full significance of the advantages Ceylon is giving up, and writes: "We are glad to see that on being referred to by Lord Elgin, H.E. Sir Henry Blake has pointed out very clearly the fallacy of the 'pure Ceylon' tea theory—adhered to so closely (and rightly so in the earlier stages of the industry by the planting community). Planters, like the trade, know very well that very little pure Ceylon tea goes into consumption as such, or unblended with other tea. If the blending were done here, there is no reason to suppose less Ceylon tea would be used; and it is known that directly Colombo became a blending centre, there would be more buyers and business drawn to this port and greater competition attracted to the local market, with increased prompt cash returns. The P. A. Committee, in reply, once again ask Government what precautions they will take to prevent blends being exported as 'pure Ceylon.' The Committee surely know very well by this time that this could be secured by expert inspection at the Customs and special warehouses for blending in bond, from which all tea exported would be officially stamped and sealed as 'blended.' Expert inspection at the Customs will also ensure 'pure Ceylon tea' being exported—though when blended with fine Indian it might pass muster! The prejudice is too strong, perhaps, for the present against China and Java teas; but surely an experiment could be made by admitting Indian teas free for blending in bond. And from how this plan worked could be judged the advisability of either reverting to the old (the present) order, or of extending the privilege to China, Java and Japan, and of thereby making of Colombo the great central tea blending mart for the whole world." However, the objection against admitting Indian tea duty-free is too shadowy, and the advantages of the port of Colombo so great, that we need not labour the question any further.—*Indian Planting and Gardening.*

THE COFFEE INDUSTRY IN BRAZIL.

LABOUR AND OVER-DEVELOPMENT.

The State of Sao Paulo, Brazil, has 1,908,000 acres planted in coffee. There are 545,000,000 bearing trees and 140,000,000 trees that will come into bearing within three years. Sao Paulo has 4,585,000 acres of land suitable for coffee. Four hundred and twenty thousand labourers are employed during the picking season. The coffee trees are worth $312,000,000. The average yield per 1,000 trees is 2,300 pounds.

The methods in use are entirely unlike the Hawaiian practice in coffee growing. The picking is deferred until the whole crop of cherries has ripened. The labourers then strip the cherry off the branches, allowing fruit, leaves and twigs to fall on the ground. When the trees have been stripped, the fruit, with dirt, sticks and stones is raked into heaps, shovelled into wagons or cars on portable track, and transported to a river, stream or flume, to be washed in sluice-boxes. These deliver the cherry free from sticks, stones, dirt and rubbish. The cherry is then transported to huge, open-air drying floors of cement or clay. The sun-dried cherry is run through hulling machinery, graded and polished, and, when bagged, is ready for market. Santos coffee may, therefore, be produced and marketed at a profit at prices which would drive our Hawaiian growers out of the business.

Labour, during the picking season, commands high prices, and there is always a shortage during that period. Even paying the higher prices that labour commands during the busy season, the Brazilian growers can produce coffee at a lower price and still make a profit, because their methods of picking and handling the crop are cheaper than ours. The Sao Paulo method is also better adapted to the needs of the small individual planter who can market his coffee to the large planters and mill owners in the dried cherry, practically the only investment of capital, other than his own labour, that is required, being the comparatively small cost of a drying floor.

This simplification of methods is responsible for the enormous over-development of the coffee industry of Brazil. Hundreds of thousands of European immigrants, German, Italian and Portuguese, have poured into this salubrious, rich and well-watered region. As large an area as has been already planted is still available for the development of this industry in Sao Paulo alone. Extraordinary inducements have been offered by this and other Brazilian States in the way of lands, prepaid ocean-transportation, loans to settlers, and in some instances guarantees of at least $400 wages per annum. Road and railroad development have kept pace with the settlement of the land.

The price of labour is approaching a parity in all civilized countries within the tropics. A land or an industry which has an advantage over other lands and industries, through the possession of cheaper labour, more fertile soils, more stable government or legislative, and hence artificial protection, can be depended on to rapidly bring itself up to the general average because of the universal desire to take abnormal profits. Sooner or later and, now-a-days, sooner, the endeavour to get out of an industry all there is in it, consequent upon this phase of human nature, will bring about over-production. Sometimes there is actual over-production of crops resulting in readjustment of prices in the world's markets, and widespread ruin in far distant lands. The synthetic over-production of indigo in Germany became a famine factor in India. But modifications in indigo manufacture in India have again placed the Indian ryot on a place of fair competition with German synthetic manufacturers.

Again, over-development takes the form of planting a larger area of land than can possibly be cultivated by the visible supply of labourers. This was the secondary cause of over-production of coffee in Brazil, and is somewhat of a factor in Hawaii to-day, affecting the cost of production of sugar. The world-wide remedy for this latter phase is to substitute small landowners for the plantation system of corporate ownership of land and the employment of labourers in masses. This remedy is being applied to relieve the coffee situation in Brazil.—*Hawaiian Forester*, January, 1906.

THE COCONUT INDUSTRY OF TRINIDAD.

The important place this industry holds in the resources of Trinidad cannot be gauged directly by any official publication of trade statistics. Its products of nuts and oil are largely consumed in many different ways locally, and the industry being under no legislative restrictions, by which its products would be definitely known, it is somewhat difficult to estimate its importance.

The usual practice in planting coconuts here is to clear and burn the land, which is then lined and staked, the stakes being 25 feet apart; holes are dug at each stake into which the seed-nut is placed and barely covered with earth. In some cases the seed-nuts are imported nuts of known quality, and in others they are selected from heaps on the plantation, but these are exceptional cases, and I do not think it is too much to say that sufficient attention is not paid to the selection of seed-nuts.

In Ceylon seed-nuts are selected from trees of strong and robust growth, and of middle age, producing large nuts with thick and heavy kernels; the nuts are allowed to mature on the tree, and when picked are lowered by hand and not thrown down as is usual here. Nurseries are prepared in good land, in or near to the field to be planted, by trenching 18 inches deep and dividing into beds 3 feet wide. The seed-nuts are laid side by side on the beds, and the spaces between filled in with earth, after which the beds are covered with grass or straw to the depth of 3 inches, and water is applied frequently, especially during dry weather. After six months the young plants are removed to other nurseries where they are planted 3 feet apart and where high cultivation is concentrated upon them. When the plants are from two and a half to three years of age, the whole field is cleared, lined, and holed, and the plants from the nurseries are transplanted to the positions they will permanently occupy. All nuts which are slow in springing in the first nursery are rejected and not replanted into the second, and any plants in the second nursery which do not show vigorous growth are also rejected; so this method gives opportunities for an exceptionally good selection of seed, and it is claimed that fields planted in this way are most regular and yield the largest number of nuts per acre. The saving effected by not having to keep the whole field clean for the three years during which the plants are growing in the nurseries, is claimed more than to cover the cost of the nurseries and transplanting three year-old plants.

After planting, the young trees should be kept free from grass and weeds until they come into bearing; here it is usual to keep only such land as is occupied by the young trees clean, and this practice has its advantages as it keeps the unoccupied land under cover and economises labour. Fields come into general bearing here between the ages of from 12 to 20 years, depending upon the quality of the land and mode of cultivation, but from the fact that many individual trees begin to bear at eight years of age it may be inferred that, with a more careful selection of seed and a more liberal system of cultivation, this long period might be considerably reduced.

From the time crops are reaped there is a constant drain of plant food from the land, which must be made good somehow, or the ultimately inevitable exhaustion of this plant food must bring about failure of crops. This exhaustion depends upon what part of the produce is removed and not returned to the land, as the husk, shell, oil, and meal contain the more important plant foods of the soil in different quantities and proportions. Thus, if only oil is shipped from the plantation and the meal and ashes of the husks and shells used as fuel are returned to the land, the loss will be of little consequence, especially if the meal is fed to stock whose manure is utilised. If, on the other hand, the unpeeled nut is shipped the loss is great.

Analysis of the different parts of the coconut show that 1,000 husked or peeled nuts remove from the soil 5·22 lbs. of potash, 4·95 lbs. of nitrogen, 1·60 lbs. of phosphoric acid, 1·18 lbs. of sodium chloride, and 0·48 lb. of lime, which suggests kainit, basic slag meal, and green soiling with a leguminous plant as a cheap and effective system of maintaining the fertility of a coconut plantation.

Little tillage or manuring has been done hitherto on Trinidad plantations, which is probably accounted for by the fertility and suitability of our soils at present under coconuts, and the shortness of time the best plantations and those under most intelligent management have been in cultivation; but one has but to compare them with some of the older plantations to see what they may come to if this is neglected.

The coconut palm bears all the year, the flowers and mature nuts being seen on the same palm at all times, but, as a matter of convenience, generally only two pickings per year are made, when only the mature nuts are supposed to be thrown down. In Sumatra the Malays have trained baboons to this work so effectively that only fully matured nuts are picked, but in Trinidad our more intelligent picker knows that the more nuts per tree he picks the fewer will be the number of trees he will have to climb, with the result that even under constant supervision a considerable number of immature nuts are picked. As such nuts are inferior for copra or oil making, and if shipped depreciate the value of our nuts in the markets, this has become a serious problem and one which the highest authorities in Trinidad think can be solved only by allowing the trees to drop their nuts, and employing men only to free the crowns of the trees once annually of dry spathes, stalks, leaves, and ants' nests.

The nuts having been picked, they are collected into convenient heaps where they are either opened and the kernel removed when copra or oil is to be made, or husked and selected if nuts are to be shipped, the kernels being conveyed to the drying house or the nuts to the shipping plaee.

The copra-drying house is similar to the ordinary cacao drying house, and the only manipulation required in drying copra is frequently to stir and turn over the pieces so that all parts may be exposed to the drying influence of the sun and wind. From five to ten days may be required to dry copra thoroughly, the time depending upon the sunshine and atmospheric conditions. The problem of artificially drying copra is simple compared with that of drying cacao, but from the design of some of the artificial drying houses one sees in Trinidad it is aparent that it has been misunderstood by many. Heat is of secondary importance, being only useful in enabling the large volume of dry air, which is essential, to absorb more moisture than it otherwise would in its passage through the copra : whereas, usually, heat takes the first place, and ventilation or the means of circulating dry air and removing the moist air has been omitted or given a secondary place.

The process of manufacturing oil from copra is simple, it being necessary only to disintegrate the copra so as to rupture the oil cells, the meal being then placed in bags and subjected to a pressure of about 2 tons to the square inch in hydraulic presses until the flow of oil ceases. A high extraction depends upon the degree of fineness to which the copra can be reduced, or, in other words, the complete rupture of all oil cells. From a plantation's own copra an extraction of 56 gallons of oil per ton of copra may be expected, and from ordinary commercial copra a fair average extraction would be 153 gallons per ton, and in most plantation oil factories the value of the residual meal as a stock food covers the cost of manufacturing oil.

As a very large proportion of the oil manufactured is sold locally, where the demand does not call for a high quality, little attention has been given to refining, simple filtration or subsiding being resorted to; but the time will come when higher prices will be obtained for oil of high quality, and it would be well for coconut planters to be prepared to take advantage of them. High-class oil can be made cheaply by the use of Fuller's earth in the filtration of oil made from good copra, but good copra can be made with certainty only by artificial drying, and although sun-drying houses will always be useful, an artificial drier can always be run economically as an adjunct to an oil factory, and every factory should be equipped with one.

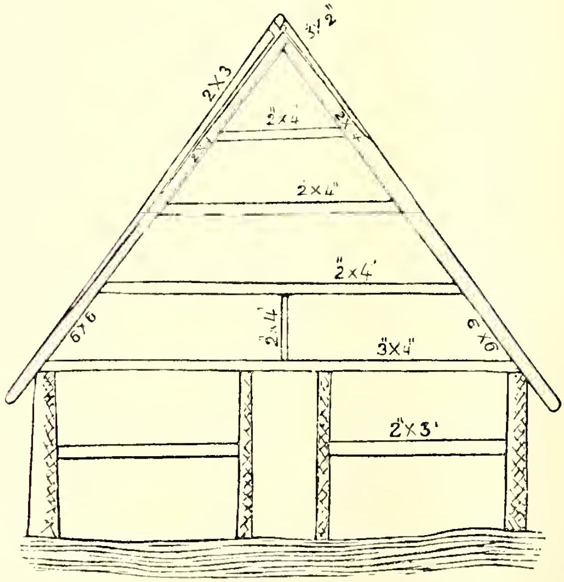
There are good reasons why many of the items exported under the head "coconuts" from other coconut producing countries cannot be so exported here; for example, dessicated nut, the manufacture of which requires much cheap labour ;

poonac or coconut meal, which is locally consumed; arrack or coconut toddy, about which the less said the better, owing to its pernicious effects; but why no use has been made of the husk to produce fibre, which is shipped from Ceylon under five heads, it is hard to say. The necessary machinery is simple, as is also that for converting the fibre into yarn, rope and mats.—*W. Greig, in Colonial Reports (West Indies) No 36: 1906.*

Cultivation and Curing of Tobacco. II.

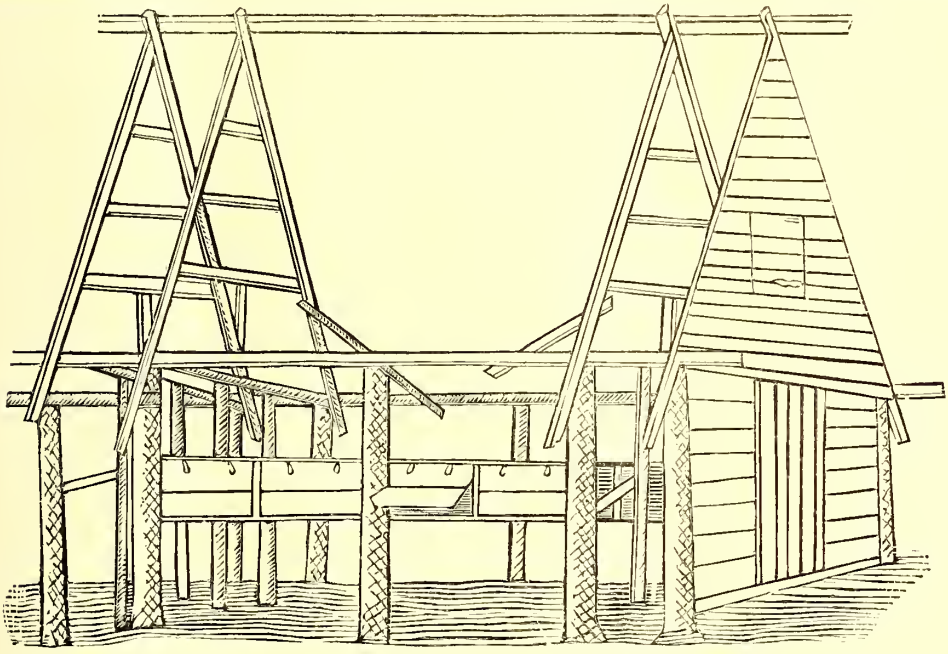
The Curing House.

A tobacco curing house should be constructed in such a way as will enable the operator to shut out very dry and very damp air, when either of the two extremes occurs, as it is most essential when tobacco is drying that the atmosphere be at all times warm and dry but not of a parching dryness. The non-conducting thatched roof, and shutters constructed as in drawing No. 2, with the assistance of the door as a means of ventilation, will ensure this. Each 'room' should be 14 feet long, with a space of 3 feet between to enable the workmen to move the bars of tobacco from one 'barradera' to the other, and for ventilation. The posts should be so arranged that each room of tobacco is supported by four of the stoutest, the latter being about 3 feet in the ground. These should be of good durable wood and not less than 8 inches in diameter at the top; the two smaller posts support the shutters and, to some extent, the roof. The posts that form the central passage (fig. 1) may be 3 inches to 4 inches in diameter, perfectly straight and smooth.



A Tobacco Curing House. (*Fig. 1.*)

A house of three rooms of the dimensions shown should be capable of drying a crop of two acres of tobacco. Having decided how many rooms will be required, the first operation in the building is to line off, peg, and dig the holes for the posts; when this has been properly started, the barraderas and frames should be made and stacked ready for putting into position. The posts are then set up, plumbed and lined, half filled in and rammed, then sawn level at the top to a line stretched from one end of the house to the other; they are then plumbed again and filled in and rammed firm. The next to go up is the 4 inches by 4 inches plate; this will have been constructed and lightly put together on the ground, so that it can be put up in sections; the splices should always be at the top of a post, and a main one if possible. The next to be fixed are the 3 inches by 4 inches barraderas (fig. 1) joining the 4 inches by 4 inches plate at both sides of the house and the main posts; after these the barradera frames braced, as shown in fig. 2, the 3 inches by 3 inches scantling at the top, then the ends and shutters; after these the roof rafters, the 2 inches by 3 inches movable barraderas (fig. 1), and then the thatch; and lastly 'wattle and clay' the walls.



A Tobacco Curing House. (*Fig. 2.*)

For two acres of tobacco about 350 bamboo bars, 15 feet long and 3 inches in diameter, will be required on which to hang the green tobacco, and a good quantity of dry "Jippi-jappa" thatch heart should be procured for tying the plants in pairs preparatory to hanging on the bars.

Cutting.—If a careful watch be kept on the field, it will be noticed that some few of the plants will begin to ripen; these may not be cut yet until a sufficient number has ripened to fill at least ten bars; then go through the whole field and cut out all that are quite ripe and those that have not quite finished ripening the top leaf.

The best time to commence to cut is about three o'clock in the afternoon, and continue until dark. The leaves then contain very little moisture, and are, on that account, less brittle and less liable to break, and they also dry much quicker than when cut in the morning. This, however, may be done only when there is no danger of rain falling in the night, as the plants have to remain on the ground until the next morning; a light shower will not affect them and heavy rains only do so by splashing them with dirt.

The best method of cutting is to lay hold of the top of the stem with the left hand, bend the plant over a little, and cut it off at the level of the ground, taking care not to injure the young ratoons that are springing from below the surface. The cut plant may then be turned upside down, and the base of the stem, as far as the first good leaf, cut off (at the base of the ripe plant there are usually one or two small leaves that are over-ripe, spotted and blistered, and of very little value commercially). They are then laid on the ground in heaps of three or four plants in the interval next to that in which the workman is cutting, each man taking two rows, on each side of him. Whilst it is much better if the plants are allowed to remain on the ground all the night, it is more advisable to cut in the morning if the weather is at all unsettled; the only difference is that great care is necessary to prevent the plants getting scorched when lying on the ground to 'quail'; they must remain in that position until the leaves have lost their brittleness and have become pliable, and as soon as they have reached that state they must be removed into the curing house, or some other shady place. If the plants are cut in the afternoon, there is no danger of their getting scorched, and they are as pliable as kid skin the following morning. There is an idea among the Cubans that the tobacco burns better if a heavy dew falls on the leaves after the plants are cut. If the cutting is done in the afternoon, do not take the plants from the ground to the house until the dew has dried off them, and if it is decided to cut in the morning do not commence until the dew has disappeared.

To secure sufficient tobacco for the three days' cold sweating a cutting right through the field should be made every five or six days rather than every day, cutting out, of course, only the ripe tobacco; should there be indications of continued rain storms, every effort should be made to cut as much ripe and nearly ripe or 'full' tobacco as possible; if rain happens to fall without due warning, the ripe tobacco may be cut during the following day and a half, but if it is not cut by that time it must be left, as the moisture has then got up into the plant and turned it green again or unripe; in this case the plants must remain in the field until they ripen again.

When the plants are carried to the house preparatory to tying and hanging, they must be spread out as thinly as possible, say, three or four plants deep; for if allowed to remain in heaps for more than half an hour, they will ferment, get hot, and spoil. It is hardly necessary to point out that the greatest care should be exercised in the handling of the plants from first to last so as not to break the leaves.

Tying and Hanging.

When all the cut plants have been transferred to the tobacco house, the work of tying and hanging should be commenced and continued until the whole has been safely hung in pairs upon the bars; the tying material must be passed around the stem and under the leaf that is nearest the base and then drawn tight to prevent the plant slipping out of the tie. The pairs of plants must be placed at a distance of 4 inches to 6 inches from each other, so that they just touch without pressure; a 14-feet bar will usually hold from thirty-four to forty pairs of plants. As the bars are filled they are packed close together on the lowest barradera and are allowed to remain so for three days and nights or seventy-two hours; at the end of this time the bars are spread out to a distance of one foot or 15 inches apart; giving the bars a shake to separate any leaves that may be sticking together, filling up the top barraderas first, one foot apart when the atmosphere is very dry, and 15 inches when moist. In re-arranging the bars care should be taken to open out the plants at each end that are liable to slide towards the middle of the bar during removal, for if several pairs are allowed to remain packed together, fungus will make its appearance and cause what is known as 'sweated' tobacco.

This is easily recognized when it appears by the black spots that it makes on the still half-green leaves, though the really first indication of 'sweat' is the swelling or thickening of the leaves, their cold, wet feel, and the appearance of moisture on the surface; these spots increase in size until the whole of the leaf is covered, and once this fungus gets a start it will extend its operations into the tobacco that is not too closely packed and eventually go through the whole house. The fungus breaks down the tissues of the leaves and renders them absolutely useless as cigar tobacco, and the very best leaves can in this way be reduced to the status of 'fonque.' The fungus will also make its appearance on partially dried tobacco if the weather suddenly changes to cold and wet after a fairly long dry spell; if the cold wet weather continues for more than a day it will be necessary to procure several old zinc buckets, knock some holes in them, make charcoal fires and keep moving them about from place to place under the tobacco; but to ensure no smoke reaching the drying tobacco, the fires should be started at a distance away from the house and not taken in until there is a nice glow.

If the fungus has been overlooked and has had a good start, it can be stopped by removing the affected bars to temporary barraderas erected outside the house, on the side that gets the morning sun; three hours' sharp sun, say, from nine to twelve, will be quite sufficient to check it effectually. If bright sun be not forthcoming the charcoal fires must be kept going until the atmosphere in the house is too warm and dry for the fungus to live. The tobacco that is put out to sun should be taken in on the least indication of rain, as the lightest shower will spoil it; on the whole, it is much the best to be on the safe side by burning charcoal fires inside the house whenever partially dried tobacco is subjected to a cold, damp atmosphere. It must be borne in mind, however, that whilst, obviously, it is possible for the atmosphere in the house to be too cold and damp, there is also the danger of going to the other extreme; whenever hot drying winds prevail all the shutters and doors should be closed to prevent the tobacco drying too quickly; and, on the other hand, they should be closed when warm, dry, calm weather changes to cold and wet.

The last part of the leaf to dry is the base of the midrib, and when it is observed that this part of every leaf is dry and shrivelled, the bars may be double packed, that is, the pairs of plant may be closed up, so that each bar may carry the tobacco that was dried on two bars. The double packed bars can then be placed at a distance of 6 inches or 8 inches apart in the room nearest the press, and allowed to remain there until taken down to ferment. This rearrangement is best done when the leaves are not crisp, but soft and pliable; dry tobacco becomes crisp when the air is very dry and mild after a day's rain, and sometimes before rain; indeed the softening of the leaves is a reliable indication of an approaching storm.

The closing up of the dry tobacco is necessary for prolonging the final drying stages and rendering it less liable to be affected by atmospheric changes, and also provides more room and bars for the tobacco that is being brought in from the field as the plants ripen.

Pressing and Curing.

The word 'press' conveys to the lay mind an instrument constructed with numerous screws for the purpose of exerting pressure upon any substance placed under it; in reality the tobacco press is nothing of the kind, but is merely a pile (Cuban pilon) of tobacco stacked together to ferment in the same way as a mixture of manure and leaves is prepared in England for making hot beds for cucumbers and melons. In fact, it may be said that any one who has had experience in the work of the forcing department of an English garden could with safety undertake the curing of tobacco after seeing one crop cured by a Cuban; or, I may be allowed to hope, by following carefully the directions set forth in these notes. For the benefit, however, of the large majority who have not been fortunate enough to have had opportunities for observing the changes that occur during vegetable fermentation, it will be necessary to set down all the details concerning the actual curing of tobacco.

The press, then, is simply the pile of tobacco; the term, however, is also applied by the Anglo-Cuban to the receptacle in which the tobacco is stacked; and when he wishes to convey the information that he is about to ferment a 'pilon' of tobacco, he states that he is going to 'put press'—to an outsider a most mysterious phrase. This receptacle may be made of ordinary deal boards (though cedar is the best), lined sides and floor with 'jagua,' the skin or bark stripped from the inner surface of the broad leaf-sheath or petiole base of the matured and fallen leaves of the royal palm (*Oreodoxa regia*); if a sufficient quantity of this material is not obtainable, a lining of dry banana leaves (trash), some 3 inches thick, will answer almost as well.

A perfectly round press is undoubtedly the best, though a hexagonal or six-sided does almost as well and is much easier to construct; if the tobacco house has a wooden floor, the sides of the press may be built upon it; if an earth floor, the wooden floor of the press must be raised about 6 inches from the ground. It is most convenient to build the press in one of the rooms of the curing house in a part not exposed to the wind. It is best under any circumstances to have sufficient banana trash in the bottom of the press to cover it to the depth of at least 6 inches when pressed down by the weight of the tobacco that is put upon it. The heat that is evolved by the fermentation has a tendency to rise towards the top, and, as a consequence, the bottom is liable to become chilled, if it is not snugly packed and almost air-tight. Whenever tobacco is being fermented and it becomes chilled, fungus is sure to grow. The dimensions of the press should be 9 feet in diameter by 5 feet in depth; no 'pilon' should be less than 9 feet nor more than 10 feet in diameter, if nicely fermented tobacco is required; about 200 double-packed bars will fill a press of this size.

The tobacco having come safely through the drying process and the press being ready, advantage should be taken of the first opportunity to 'put press.' This occurs after a day's rain, when the leaves lose their crispness and become 'mild,' *i.e.*, as soft and elastic as kid skin. The early morning is the best time to begin the work of transferring the tobacco from the bars to the press, as everything must be finished before the atmosphere is hot and dry enough to make the leaves crisp again. On the night following a rainy day all the shutters and doors must be left open to allow the moist, dew-laden air to circulate among the plants, and before daybreak in the morning all hands should be at work. In preparing the tobacco for the press the pairs of plants should be tied into bundles of about twenty (four bundles to a double-packed bar) by passing a strand of thatch-leaf along the bar under the strings and tying them together not quite as tightly as it is possible to tie them; this will allow a loop to lay hold of when handling the bundle, and is also convenient in other ways. The bundles are then lifted off the bar and handed to a man armed with a mallet-like piece of wood with which he gently taps the ends of the stalks, whilst holding the bundle under the left arm, until they are quite even; after which he hands the bundle to the man who is in the press to stack the tobacco; the latter gives the bundle a good squeeze, and lays it down in the press with the tips of the leaves pointing towards the centre and the stalks pressed tight against the wall. When he has filled up all round the inside of the wall of the press, he must commence the next layer about 18 inches from the wall, and the next about 2½ feet or 3 feet from the wall, according to the length of the plant, so that the whole of the bottom of the press may be covered. When this is done, he is to commence at the wall again and continue in the same way as he began, until the press is filled, kneeling on and drawing the bundles tightly together as they are put in. A halt, however, must be cried when the press is half full for the purpose of inserting the thermometer, or rather the bamboo that is to hold it. The latter should be about an inch in diameter (inside), perfectly straight, and should have the partitions between the hollow joints cut out with the chisel, after making small window-like apertures on alternate sides at the nodes. The bamboo should be long enough to reach the centre of the press and should be placed thin end in, with the windows at the sides, for if the apertures are turned up and down the tobacco will press into them and interfere with the passage of the thermometer when it is taken out to observe the temperature. A hole, about 12 inches long and 2 inches in width, should be made in the wall of the press through which the bamboo is thrust; the hole is to allow the bamboo to sink with the tobacco as the fermentation proceeds. When the press is full, the tobacco is to be covered snugly with mats made of corn bags opened up and sown together; one thickness being sufficient in damp weather, two when the air is dry. Weights must now be put on to start the heat as quickly as possible; straight, smooth logs, about 9 inches in diameter laid closely together all over the top of the pilon is the usual method of applying pressure.

The last thing to be done is to insert the thermometer into the bamboo that was placed in the centre of the pilon; the bulb of the instrument should be packed neatly in cotton wool or some such non-conducting material to prevent the mercury running down before the temperature has been read. The thermometer may be attached to a piece of wire just long enough to reach the end of the bamboo which is, of course, the centre of the pilon, care being taken to keep the outer end of the bamboo plugged tightly with dry moss or a piece of rag.

In dry weather, as soon as the thermometer reveals a temperature of 118 F., the logs of wood should be removed; if the atmosphere is damp, they should be taken off when 108 F. is reached. The temperature rises much more rapidly during wet, thundery weather registering 120 in two days, whilst in dry weather from three to seven days are required to secure the same degree of heat. Whilst the tobacco is fermenting, small boxes should be got ready for the purposes of moulding the bund of leaves, when stripped from the stalks, into matulas, they should be of cedar and constructed as follows:—

Cut three pieces, 2 feet long by 7 inches deep, two for the sides and one for the bottom; cut one piece, 7 inches deep by 7 inches long at the top and 5 inches at the bottom, for the one end; these are put together, and when finished the box is trough-like and open at one end, the bottom being 5 inches wide inside. Three ordinary fencing staples are hammered into each side at about 5 inches apart for holding the strings of the matula while the box is being filled with the fermented leaves as they are stripped. When the thermometer in the press shows temperature of 120 F., stripping should be commenced. The shutters must be closed and all sources of draught plugged; banana or bag mats spread over the floor, low rough seats arranged around the room, with plenty of spare bag matting for covering the matulas when made; two-thirds of the men should have a box each, and all a supply of "thatch-heart" strings.

When everything is in readiness, the first few bundles are taken out and handed to the men without boxes who cut all the strings and pick the 'fonque' leaves from each plant; the plant is then passed along to the man who is to pick 'carpa,' then on to the 'tripa' picker. The carpa man uses three strings to his matula, the tripa matulas have two, whilst the fonque is known in future manipulations by its being tied in small round bundles about one-third the size of a matula. As the leaves are stripped they should be laid in the box over the strings with the base (the end nearest the stem) against the close end and the tips towards the open end. When the box is full, they should be pressed firmly with the open hand and the strings tied; the matula is then turned out, stacked with the others in a warm corner and covered up with big mats. The tobacco in the press must also be kept closely covered when bundles are not beinggot out. The fonque leaves are those, one or two, nearest the base of the plant that were overipe and had become badly spotted and broken in the tying and hanging; it always follows that the better the cultivation and handling the smaller will be the proportion of fonque to the rest of the crop; this proportion must, however small, be kept out of the good tobacco. The carpa are the perfect leaves and are known by their kid-like texture. The workman who picks carpa draws every leaf from end to end between thumb and fingers, taking off the soft and perfect leaves and leaving on those that have a dryish, stiff feel, which are the tripa leaves. It may here be stated that another receptacle will be required of the same dimensions as the first for the accommodation of the matulas, another press in fact. The second press should be square, as it is more convenient for the neat and close stacking of the square, brick-shaped matulas. The two presses Nos. 1 and 2 will be needed for a crop of 3 acres, and for each additional 3 acres a matula press must be provided, reserving No. 1 for the first fermentation. All the presses must be of the dimensions shown, as, to a large extent, the quality of the tobacco depends on the quantity put together to ferment; it may be too much or too little.

The stripping of the leaves and making into matulas must be done as quickly as possible, for if the temperature of the press rises to 130 F., before a quarter of the tobacco has been striped, the work is going too slowly, and there is danger of the remaining bulk getting too hot, causing what is known as wet tobacco. If nearly half the press has been striped when the thermometer shows 130 the work is going right. It should be borne in mind that from the first the tobacco should be kept warm and bulked together tightly, never allowing it to remain spread out any longer than necessary. It is desirable, therefore, that stripping should be done quickly, and the leaves packed into the matula box before they lose their natural heat, and that the matulas are packed closely together into No. 2 press and covered.

Occasionally, a wet leaf will be discovered, and these must never be allowed to go into the matulas until after they have been laid out in the shade to dry; this is most important as the wet leaves unfailingly cause the growth of fungus, and this will spread through all the adjacent leaves and spoil the lot.

When the whole of the pilon has been picked it will be seen that the resulting matulas occupy about a third of the space that the bundles took up, and if then the matulas are spread over the bottom of press No. 2, there will not be sufficient depth to retain the existing heat, much less generate more; in other words, fermentation will cease. It therefore becomes necessary to re-arrange the matulas and make them up into a neat cube in the snuggest corner of the press. This may be done by the aid of boards kept in position by props from the sides of the press, remembering to put a layer of banana trash between the tobacco and the boards, and to do the work quickly. The fonque may be packed on the top or kept separate until it is sold, no more attention being given it in the way of curing. As soon as there is sufficient tobacco dry, another pilon should be fermented and the matulas packed firmly into the space between the wall and the cube of matulas in No. 2 press, taking away the boards and trash; the next lot that is fermented jus about filling the press. A thermometer should be placed at the centre, as in No. 1 press, and should be read once a day; it will then be observed that heat is not generated as quickly as in press No. 1, requiring some two and a half or three weeks before the temperature arrives at 123 or 130 F. When the latter figure is reached, the whole pilon must be taken out and repacked, turning the bulk upside down and inside out. The room must be closed, mats spread over the floor, and the work done quickly. Four heaps should be made, one of the top matulas, one of the outside, one of the middle, and one of the bottom; this ensures accuracy in repacking. The matulas are then stacked as closely as possible in the press again (remembering the thermometer) and carefully covered as before with the corn-bag mats. This time the temperature will rise even more slowly, but will eventually reach 120 to 130 and go as gradually down again; if, however, wet weather prevails for some time the temperature will rise quickly, and, if the tobacco is not taken down and re-stacked, would probably go over the mark, *i.e.*, 130, and spoil; and if left long enough would catch fire. When the temperature of press No. 2 has risen and fallen as described, the tobacco must be allowed to remain undisturbed until the whole crop has been through the same processes when the classing is commenced; beginning, in a large plantation, with press No. 2, No. 3, and so on. The 'classing' of the crop is for the guidance of the manufacturer who buys it.

CLASSING.

This operation is a very important one, and requires considerable practice before it can be done at profitable speed; it entails the handling and inspection of every leaf. Six classes are made, three of carpa and three of tripa:—carpa larga, carpa mediana, and carpa courta; tripa larga, tripa mediana, and tripa courta; meaning respectively long, medium, and short wrappers, and ditto fillers.

As before mentioned, the tobacco is classed roughly when taken out of the first press and made up into matulas, square bundles some five inches or six inches thick; now, after the last slow fermentation, the matulas are opened up and the leaves made up into 'manitas'—small, neat bundles that can easily be encircled by the thumb and forefinger (about forty leaves) at the place in which it is tied, *i.e.*, about one and a half inches from the base end; this time exercising greater care in the selection of the leaves. It will then be found that, owing to the rapidity with which the stripping had to be done after the first fermentation, some tripa leaves had crept into the carpa matulas and carpa into the tripa matulas. It might appear that the first rough classing is unnecessary, since the leaves have to be carefully gone through a second time; in practice, however, it is not so. If it were not that, a carpa matula contained mostly carpa, or that a tripa matula could not be depended on to yield 90 per cent. of tripa, a large number of leaves would be exposed to the air unnecessarily, and this exposure means loss of aroma. The work of classing and making manitas must, therefore, be so arranged that the leaves are exposed as little as possible.

A broad table is erected in one of the rooms around which the workmen are seated; those on one side take each a tripa matula and those on the other take the carpa; the former when classing and making up, put out the carpa, and the latter the tripa, these being gathered every few minutes by the man at the end of the table who makes them up. A few fonque leaves will also turn up and must be relegated to that despised pilon at the other end of the house. In making up the manitas all the leaves must be placed, so that the bases are even and that the surface or face of each leaf is turned in towards the centre; they should be neatly rounded off and tied with a strip of thatch-heart. As they are finished they are quickly packed away closely in a small improvised pilon, carpa on one side and tripa on the other; and at the end of the day, carpa and tripa are weighed off separately and stacked neatly side by side in rows, with the heads of the second row of manitas covering about one-fourth of the width of the first, in press No. 1, which is now empty, as the whole of the dry tobacco has been fermented.

If the matulas, after having undergone the long, slow fermentation, have become somewhat dry on the press being opened for classing, they should be treated in the following manner:—

Without disturbing a leaf, the surface of the tobacco in the press should be lightly sprayed with a mixture made up of 1 oz. of essence of peppermint to

1 gallon of water, then covered with one thickness of corn-bag mat, and over this guinea grass (that has lain spread out in the shade for one day) packed closely to the depth of about 3 inches or 4 inches. Two days after, on the remova of the grass, the tobacco will be in excellent condition for handling and classing. The peppermint counteracts the smell of the grass, and if, as the tobacco is taken out and a fresh surface exposed it is found to be dry, it will be necessary to allow the grass to remain, spraying as lightly as before with the mixture at the end of each day, until the whole is classed. Some cigar manufacturers who use native wrappers in preference to Sumatra insist on the carpa leaves being classed according to their various colours :—

Claro	...	light yellow
Colorado claro	...	brownish yellow
Colorado	...	brown
Colorado maduro	...	dark brown
Maduro	...	dark

but as the use of the Sumatra wrapper is rapidly gaining ground, the classing by colour will soon be unknown in Jamaica, the native wrapper being used as the binder' (Cuban 'capoti') which is the layer of tobacco between the 'filler' of the cigar and the wrapper.—*Imperial Department of Agriculture, W.I.*

(*To be continued.*)

THE SUGAR INDUSTRY OF THE PHILIPPINES.

There has been a general disposition to ridicule the Philippine sugar industry and to consider it impossible of development, excepting by the introduction of American capital and American methods. We think this is hardly fair when we consider that in Cuba, under the domination of Spain, the sugar crop was brought up to a total of about a million tons before the Spanish war, and that in 1893 the Philippines exported 261,537 tons, while Louisiana, in the same year, made about 265,836 tons.

We give below in parallel columns the respective sugar crops of Louisiana and of the Philippines for three decades, beginning with 1868, directly after the civil war, and ending with 1898, the year of the Spanish war. The Louisiana crops are taken from Bouchereau's Report, which gives the total crop in Louisiana in long tons for the years enumerated. The data for the Philippine crops is from the evidence given in by Mr. Willett of Willett & Gray, in the tariff hearings in Washington, and is the record of the sugar exported from the Philippines, the total crop for the years named being probably 5 to 10 per cent. greater than this record. It will be noticed that there is considerable parallelism between the crops of the Philippines and Louisiana for the years given, and that it was only in the year 1893 that Louisiana began to surpass the Philippines in sugar production. It will also be noted that the total production for the thirty-one years under consideration, 1868 to 1898, inclusive, was 673,000 long tons greater for the Philippines than the production in Louisiana during the same period. If we add 6 per cent. to the production of the Philippines for home consumption, the record of these three decades would show that the production of the Philippine Islands was a million tons greater than the sugar production of Louisiana during the same time.

The Philippine sugar industry had attained as great progress as had that of Cuba. It was well organized, as such tropical industries were then organized, and the Philippine sugar product was one of the important factors in the markets of the world. The American exploiters of the Philippines endeavoured to deride this industry and to refer to the quaint little mills and queer old-fashioned devices in use among the smaller sugar producers as though they were typical, whereas the sugar industry of the Philippines has for 75 years been well organized and always progressive. The maple sugar industry in the Philippines seems to exist there in a miniature sort of way, but to have no particular status as a factor in the sugar world, and is to be regarded rather as an agricultural curio, a reminiscence of the old Spanish days in the far interior, just as some of us can recall now our boyhood experiences in equally quaint maple sugar establishments in the Northern States of the Union.

The sugar crop of Louisiana has become an important factor in the sugar world, opening as it does the cane sugar markets of the western world every autumn, and setting the pace in the way of prices. That the Philippine sugar industry should be a larger one than that of Louisiana will be a surprise to many of our readers, and when we reflect that from the data brought out in Washington during the recent Philippine tariff discussions, it was shown that the islands were capable of producing many millions of tons of sugar per annum, we can readily perceive the disastrous results that the free admission of Philippine sugar into the United States, or any material abatement in the present tariff on Philippine sugar, would bring to our domestic sugar industry.

The tabular statement of the product of Louisiana and of the exports of the Philippines from 1868 to 1898, inclusive, is given below in long tons:—

Year.	Louisiana.	The Philippines.	Year.	Louisiana.	The Philippines.
1868	42,617	74,080	1884	94,372	122,925
1869	44,382	68,827	1885	127,958	212,791
1870	75,369	78,212	1886	80,858	182,185
1871	65,635	87,465	1887	157,970	159,146
1872	55,891	95,526	1888	144,878	181,256
1873	46,078	89,338	1889	128,343	218,925
1874	60,100	103,862	1890	215,843	147,521
1875	72,958	126,188	1891	160,937	166,410
1876	85,102	130,430	1892	201,816	246,141
1877	65,835	122,411	1893	265,836	261,537
1878	106,909	117,926	1894	317,306	192,409
1879	88,836	134,804	1895	237,720	226,168
1880	121,886	180,748	1896	282,009	221,775
1881	71,304	211,417	1897	310,447	202,078
1882	136,167	150,993	1898	245,511	178,347
1883	123,318	215,236			
			Total	4,234,191	4,907,077

—*The Louisiana Planter*, April 21, 1906.

SUGAR-CANE GROWING IN TRINIDAD.

Cane farming in Trinidad seems to be prospering, notwithstanding the incidental difficulties that come in the way of the development of any new industry. And when we note that the beet sugar factories won't go into the business unless they can secure a pledge of a beet supply, we are led to wonder why cane sugar factories should ever be reluctant about contracting for the farmers' supply of canes, always provided the prices are reasonable and that the cane is offered under practicable conditions.

A recent issue of the *Port of Spain Gazette*, referring to the cane harvest in Trinidad, says that the farmers' canes flow in abundance to the factories, and so much so, that some of them have had to check the supply. At one particular factory 300 carts, heavily laden, were there at one time awaiting discharge. This delay in taking the canes had led some of the farmers to go to more distant factories, seeking a market, they being entirely unwilling to wait their turn at other factories nearer home.

Our confrères in Trinidad will hardly ever get this matter satisfactorily settled until they adopt some plan of percentage delivery. For instance, if the prospective campaign should be one of a hundred working days, then the cane farmers, to be placed upon an equality with the planter's own supply of cane, should be allowed to deliver one per cent. of his crop on each working day. A party with 100 tons from this point of view could only deliver one ton per day. When the deliveries are made very small they may become unremunerative to the farmer, owing to the difficulty that he would have in organizing his domestic force for so small a delivery. In that case local farmers could be taught to club together and work for each other, exchanging in kind or for price. In this way, a farmer restricted to but one ton delivery per day, joining with four others, they unitedly could deliver five tons from one of the party each day, and in five days complete the circle of deliveries and giving the same results to the factory.

We have been led to infer that some of the opposition that has developed in Trinidad to the cane farming industry has been from the fact that the cane farming diverted a considerable amount of good labour from the planting industry over into the cane farming industry, and the interference was so great as to be considered actually injurious. This may be the case in Trinidad, but, as referred to above in the instance of the beet sugar factories, so it is with most factories. They won't go into business unless they have assurances of a competent supply of the raw material to handle. The margin in the production of sugar to-day is so small that an immense supply of cane is required, and experience in Louisiana and in Cuba has shown that the development of the cane farming industry is an essential feature of the central factory idea in sugar production.—*The Louisiana Planter*.

GUAVA FRUIT PULP.

Although the remarkable fecundity and capacity for reproduction of the guava has earned for this plant an unenviable reputation almost equal to that bestowed upon the less useful lantana, for taking possession of pasture land, yet there is very little doubt that if properly attended to, a very profitable return might be derived from the fruit. In many of the outlying districts of the islands, upon land which has either been abandoned to this plant and those of similar capacity for encroachment, or upon tracts which have heretofore been uncultivated on account of their sterility, enormous quantities of wholesome fruits are allowed to go waste. This might all be used to profitable advantage if a system of fruit-pulping were introduced similar to that which is employed in many of the agricultural districts of France. The general scope of the method suggested is for the local growers or pickers to preserve the guava pulp in large containers, by an inexpensive and simple plan, and in this form to send it to a central jelly factory for future use.

The pulping is in France usually conducted on a large scale, but it should also be as easily and advantageously carried on with smaller quantities of fruit. The apparatus used consists merely of a copper pan and a metal tank. The fruit to be pulped should, after removal of the rind, be placed in the copper pan and heated to boiling, during which process it should be continually stirred with a wooden spoon. After boiling for a sufficient time it should then be emptied into tin containers which are soldered up. The tins are then removed to the metal tank in which they are immersed in boiling water for about twenty minutes. During this process, if any of the tins are not sufficiently soldered it will be detected, and in this case they must be removed. The quality of the product depends on the degree of cleanliness observed, in the care which is exercised to prevent burning during the process of boiling, in the kind of tins employed and in the manner of soldering. If thoroughly cleansed kerosene tins could be employed, the cost of producing the fruit, to which must be added the freight to a central factory, should not be more than from $1·75 to $2·15 per hundred pounds. The best quality of pulp is obtained in France by steam heating instead of fire directly applied to the pans. This method is desirable in the more delicate kinds of fruit, such as the apricot and peach, but it should not be necessary in the guava if sufficient care is taken. As a rule a small quantity of water, varying with the kind of fruit used and which may be easily determined, is added to the pulp to assist in preventing burning. There seems in this proposed industry to be a splendid field for a man of small capital to establish a central jelly factory in Honolulu, and to supply it with fruit pulp from a few pulping plants situated in favourable districts.—*The Hawaiian Agriculturist.*

THE MANUFACTURE OF SAMSHU (CHINESE SPIRIT) FROM SORGHUM VULGARE.

This industry is largely carried on in North China and Manchuria, and in a lesser degree all over China. The process, though intricate in detail and not easily described, is really very simple. Briefly, the main points are as follows :—The sorghum grain is first crushed, then moistened, and a quantity of the ferment agent ground fine is thoroughly mixed with it. The mixture is then put into concrete pits, and trampled firmly layer upon layer. When the pit is full it is covered over with boiling husks or chaff, and a layer of adhesive clay is spread over all. (These pits are usually 10 feet deep, 7 feet long, and 2½ feet broad, and capable of holding 1,680 lb. of grain.) The clay forms an air-proof cover, beneath which the chemical changes antecedent to distillation proceed. Great heat is generated, and from time to time an opening is made in the clay cover and an iron bar thrust to the bottom of the pit to test the state of the mixture, and to allow of the escape of superfluous gases.

After 18 days the mixture has undergone sufficient chemical change, and is ready for the first distillation ; the grain is partially decomposed, and has a sweet spirituous taste. The grain is now moved from the pit, and placed in a wooden steamer fitted with a lid having a round opening in the top, whereon rests a condenser with its overflow pipe and draining-tube. This steamer is fixed to a grating resting over the top of an iron pan filled to within a foot of the steamer with water. A fire is then started beneath the iron pan, and, as the water boils, the steam passes up through the spirit-laden grain, vaporising and carrying with it the spirit to the bottom of the condenser, whence it trickles down the draining tube to the receiver. The condenser is filled with cold water, and as this gets heated and escapes through the overflow pipes a fresh supply is added. After two hours the whole of the spirit has passed over, and the contents of the steamer are removed and re-packed in an empty pit for a further period of 18 days, when they are ready for a second distillation. Four or five distillations are made ere the grains are finally flung to the pigs, a certain quantity of fresh grain being added for the second and third distillations. The quantity of spirit yielded by one stilling, in which 1,680 lb., of grain are used, averages about 650 lb.

The spirit is tested by adding water, and watching the quantity of froth which forms when the mixture is shaken ; if one-fifth of its weight can be added to the liquor without considerable froth forming it is considered 'proof spirit. Rectification is unknown in the distilleries, but a more palatable and stronger liquor may be procured in medicine shops, where re-distillation on a small scale is practised.

The Samshu is packed in earthenware jars carefully stoppered with clay and also in wicker baskets lined with tough paper. The ferment used is made in summer by mixing barley and peas in the proportion of three of barley to one of peas. The mixture is coarsely ground, and water added until a consistency of putty is reached. It is then pressed firmly into wooden moulds in size and shape like brick-moulds. The 'bricks' are then piled 4 to 5 feet high, in a room just as are bricks in a kiln, with interstices for the free passage of air. The room is kept at an equable temperature, and draughts are rigorously excluded. Fungoid growth soon appears, and the correct temperature being maintained, gradually permeates the whole brick. About forty days are necessary to complete the culture. When properly dried and stored, these ferment-bricks retain their active properties for four to five years.

The above methods are those employed in North China and Manchuria, and I would refer those in search of further detail to "Manchuria; Its People, Resources, and Recent History," by Alex. Hosie, published by Methuen & Co.

In Western China, especially Szechuan, considerable quantities of Samshu are manufactured, but here, unkusked barley, maize, and sorghum in equal proportions and all mixed together are used. Rice-husks are added in the proportion of one part to twenty of the mixture. This mixture is first well steamed for an hour; then piled in heaps on a clean concrete floor, and boiling water added liberally. It is allowed to remain in these heaps until fairly dry, when it is spread over the floor, and pulverised ferment is thoroughly mixed with it. The whole mixture is next put into a concrete pit and covered over with clay. In this pit it remains for a month (being occasionally examined by aid of an iron bar) and is then ready for distillation.

The process of distillation is similar to that detailed above. Four distillations are made, at intervals of a month, a small quantity of fresh grain and rice-husks being added for the second and third stillings. The quantity of spirit yielded by this mixture is much less than is obtained from the pure Sorghum in Manchuria, but of a stronger nature. The ferment used in the West of China is prepared from wheaten flour.—*Gardeners' Chronicle.*

EXTRACTS FROM TRADE REPORT, LONDON, JUNE, 1906.

CAMPHOR.—Firmer for Japanese refined tablets, sales at from 3*s*. 7*d*. to 3*s*. 9*d*.

CHILLIES.—Lower at auction: 200 bales of ordinary dark mixed Mombasa were offered without reserve, of which only 20 bales sold at 16*s*. 6*d*.

CLOVES.—At auction 55 bales Zanzibar were offered and bought in at 7⅛*d*. per. lb for fair; 5 boxes Ceylon offered and sold at 10½*d*. for good picked and 9¼*d*. for dark.

PEPPER.—Fair white Singapore at auction was bought in at 7⅛*d*, and a few bags good Ceylon realised 6⅛*d*. to 7*d*.—*Chemist and Druggist*, June, 1906.

SCIENTIFIC AGRICULTURE.

THE IMPORTANCE AND NECESSITY OF SEED SELECTION.

Many and varied are the conditions under which agricultural practice is carried on. Plants are as dependent on food and air for existence as animals, and the more highly specialised the plant, the greater the need for care and attention. Never should we forget that by subjecting plants to high cultivation for our own ends, we have made them constitutionally more delicate. Besides, we have upset the balance of nature by establishing hundreds of thousands of plants, of the same order, at the same stage of growth in close proximity. Therefore when insect pests and fungoid diseases begin to work in our midst, they have every chance to play havoc. All crops as at present cultivated have undergone great development under the guidance of man, so that there is ever present the tendency to degenerate or revert to their original condition. This inclination is counteracted by growing the plants in a suitable soil and climate under good cultivation, but most of all, by careful selection of the seed. This fact should be firmly impressed upon the minds of all those interested in economic plant life, as it cannot possibly be overestimated.

In many countries we have large numbers of trustworthy seed-merchants whose very existence depends upon being able to supply customers with proved seeds for every kind of crop. Very often something really excellent is brought out. This is named and put on the market at a fancy price. In this country seedsmen in the ordinary way are non-existent, so that each planter is thrown more or less on his own resources for the supply of seed for the various crops. This in itself is a blessing in disguise, provided the present indifference and inaction gives place to strenuous efforts being made by each and all for the production of good seed. The older agriculturists talked loud and continually about the desirability of often changing the seed. This undoubtedly had many advantages, and under the old order usually increased returns were obtained by its adoption. The reason, however, is not far to seek. These farmers of olden times grew crops year after year without any idea of saving the best of the crop for the following season. They expected the yield to dwindle, unless plenty of cultivation was put into the soil, and this supplemented by ample dressings of manure. But the remedy was at hand. They could purchase approved seed for their whole area at almost a moment's notice. They understood thoroughly what they were doing, and were far-seeing enough to take into full consideration the conditions under which the purchased seed had been grown. A later generation of farmers, whilst convinced of the advisability of changing the seed, did not do it quite so often, and they worked under a different system. They bought the best seed obtainable in sufficient quantity to sow an area, the crop from which would give seed to plant up what was required in the following year. This newly-introduced seed was grown on the best land and given every chance. It is an excellent practice in many ways. The outlay for seed is relatively small, whilst one year's growth in the district accustoms the plant to that particular soil and climate. Also, if the yield is in any way unsatisfactory, that variety can be discarded, and a fresh one substituted at a minimum of loss. When the live-stock question was under discussion, every one acceded that the introduction of new blood of the best kind into the herd was absolutely essential if vigour and stamina were to be maintained. But then it was acknowledged that the best animals were bred on the spot, and could not be purchased at any price. This was because care had been taken in the selection and mating of the animals.

This idea ought to be carried into the domain of plant life. A frequent change of seed may be highly desirable and profitable under some conditions, but it is ridiculous and unsatisfactory in every way for a grower to change his seed year by year. Ample proof has been given over and over again that in any particular district seed can be produced by selection, which for vitality, immunity from disease, and crop producing qualities, far excels that of any variety suddenly dumped down from outside sources. The older growers exercised no care whatever regarding their seeds, so that the manifold advantages of changing the seed were, in their particular case, very evident.

Cotton is the crop in which we are at present most interested, but the methods to be described are applicable to every crop under cultivation. For the production of high quality and big yields, failure can be the only result if the best seed be not sown, no matter how good the cultivation or liberal the manuring. We are all cognisant of the methods adopted to improve, or even to keep up to standard, any herd of animals. The weak and puny are eliminated, and quality is the one aim kept in view. The advantages are evident, even to the man in the street. Carry this conception into the plant world, and it will be seen that if any variety of plant is to be kept vigorous, we must try to keep the scraggy weaklings from propagation. This is our only hope if we wish paying crops. Below are some of the methods at present adopted for improving crops, many of which can be carried out by the ordinary farmer.

(1.) Reserve the best part of the crop for seed. (2.) We may keep back for seed purposes the biggest and best developed seed from the whole crop. (3.) Spontaneous types or sports may be found differing completely from the other plants. If these have superior qualities the seed should be treasured and carefully planted out next growing season. (4.) By raising plants from seeds instead of from buds. (5.) By raising plants from seeds instead of underground stems. (6.) By cross-fertilisation or hybridisation.

(I.) THE SAVING OF THE BEST PART OF THE CROP FOR SEED.

The commonest way adopted is to reserve a certain area for seed purposes. This is given full opportunities for good development, and the resulting crop is kept back entirely for next season's sowing. Another method, and no less commendable, is to go over the growing crop and note any particular areas of great promise. The seed from the selected portions is carefully set apart for next year's crop. But neither of the above is sufficient if we wish to progress on the right lines. For example, we wish to develop varieties of cotton which, above all its other qualities, must be an early ripener. What system should we adopt to attain that end? We must collect the early ripening bolls, and after ginning this cotton by itself, reserve the seed for the propagation of the crop. That this is sound and efficacious has been demonstrated times without number. Perhaps the best object lesson in this respect is to be found in a careful study of Sea Island cotton which to-day stands pre-eminent. Long ago when cotton seed was first introduced into that district it failed to give a crop in its first season. The plants died down, but in the spring of the next year grew up and managed to ripen a few bolls before the end of the second season. The seeds from these were again planted with great care. The method was assiduously followed up until to-day we find the Sea Island cotton ripening its crop in one season. And not only so, but, in the meantime, the length, strength and fineness of the product have been enormously improved, so that now-a-days it is unequalled on the market. Perhaps a more homely illustration will add weight to what has preceded. The progenitor of such diverse plants as the turnip, cabbage, cauliflower, kohl-rabi, etc., was one and the same, growing in its natural habitat on the sea-shore. But man stepped in and by persistent and continued guidance has evolved totally different plants. Root development has given us the turnip, a collection of flowers the cauliflower, whilst the cabbage is merely an accumulation of leaves. It needs no epicure to distinguish them when cooked for the table, or one deeply versed in horticulture to label them whilst growing in the garden. Their characteristics are so definite and distinct. But take the seeds of the above plants, and an expert would come to grief in his attempt at classification. The reason for this being that the efforts of cultivators have been directed to making modifications in the plants themselves, and have overlooked or neglected the seed entirely.

If we wish to select seed from our cotton crop let us be certain that the plants now growing are from pure seed and not mixed in any way. Egyptian seed at the present time is far from pure. You cannot buy pure Affifi seed and be certain that no other varieties are present. This is easily accounted for. In Egypt large ginning factories have been established where different varieties of cotton are dealt with. Mixing of seed can easily take place, either at the gins, or in the riddles where the seed is separated if required for sowing purposes, the small and broken seeds being rejected. Thus after one variety of cotton has been through the machinery, unless great care is taken to clean up all the seed, mixing follows when the next kind is being dealt with.

It must also be remembered that much mixing takes place on the farm, where two or even more varieties are often grown. This mixing may take place in picking or by being put in the same store. In resowing for blanks mistakes are also prevalent, a different variety being used to the one originally sown. Also a certain amount of crossing takes place when different varieties are grown near each other. Can we wonder then that seed is often badly mixed, because, if growers take no pains to keep the varieties separate, no amount of care at the ginning factories can produce pure seed.

For seed purposes the ideal condition is for each grower to gin his own seed. In Egypt this system has not been followed, with the result that mixed seed is found everywhere. Even to-day a big percentage of seeds belonging to an old native variety, called Hindi, is found in every consignment of Egyptian seed. Both plant, seed, and fibre are readily recognised. Needless to say, it was found in all the British Central Africa plantations, and its true value and significance have been pointed out to all cotton growers. The plant is hardy, grows like a bush, with plenty of promise as regards fruit. Its leaves are smoother and more circular than the other varieties. The bolls are divided in four sections. Egyptian and Sea Island cottons have three only. Its fibre is white, very short, and the lint is practically filled with seeds. This can easily be demonstrated by taking a ripe boll and pressing it between the fingers. The seeds are black, rather triangular and are provided with a sharp point. The lint leaves the seed entirely, whilst a tuft always remains on true Egyptian seed. The plants should always be uprooted when recognised. If it matures, the cotton should be ginned and sold separately, and none should ever be kept for seed purposes. This is very essential, or otherwise with its prolific and hardy qualities in a few years plantations would be filled with this rubbish, and growers would be happy under the mistaken assurance that they were growing Egyptian cotton.

In America some years ago whole fields of young cotton were destroyed by the wilt disease. Some observant planters noticed that occasionally a plant remained. These they reared and preserved with until now disease resisting varieties are on the market, and what promised to be dire calamity to the planting interest has been averted. Perhaps, if the coffee plant had been taken in hand in the same way, different results would now be seen in the Highlands. Everything points to the fact that coffee with careful selection could be made to flourish on the heavily impregnated iron soils, which are so abundant in this country. Investigators at the present time are devoting their energies in many directions. Many are working to establish and fix a type of cotton plant which will ripen its bolls at the same time. This is to lessen the expense of picking, which in many places constricts the area and diminishes profits. If this object is successful, it is hoped to bring forward machinery to take the place of the slow and laborious drudgery of hand-picking.

It is well known that the seed of American cotton as a rule is covered with short lint. This occasions great difficulty in ginning by the roller gin, in fact, in that country the saw gin is in universal use. This gin breaks and twists the fibre so that its value is very much lessened. They are selecting lint-free seed from ordinary plants and even crossing the existing varieties with smooth-seeded varieties like Egyptian. In this way they hope to develop an Upland cotton which can be easily ginned by the roller gin and so increase its market value. Strenuous efforts are also being made to develop early ripening varieties of cotton. These are for cultivation in the northern districts where the growing season is short. It has also been found that to counteract the ravages of the boll-weevil, early ripening varieties are the planters' only hope, where the pest is troublesome.

A comparatively simple method of selection, which could be undertaken by everyone, is as follows:—Train six or eight men to distinguish healthy well-developed trees from the others. Before the general area is picked, send these men to gather the crop from the trees thus fitted for seed production. Well-branched and not spindly or leggy trees should be chosen. If possible, the pickers should know something about quality, yield and early ripening. If under careful supervision, the seed from the cotton thus gathered will give results far superior to that from the general crop. Another way is to purchase a small quantity of the best seed and give it every care, reserving the resulting seed for the general area under cotton the next year.

(2.) The Keeping Back for Seed Purposes of the Biggest and Best Developed Seeds.

The keeping back for seed purposes of the biggest and best developed seeds from the whole crop is a step in the right direction. But it does not go far enough. It, however, ensures that the seed contains a supply of nourishment sufficient to give the young plant a good start in life, and to tide it over any early struggles for existence.

(3.) Spontaneous Types or Sports.

Spontaneous types or sports frequently occur in plant life. These differ greatly from the surrounding plants, and if the qualities of the product are in any way superior, the type should be propagated and tended until it becomes fixed. Sports result chiefly from natural crossing in the field or from the influence of soil, climate, and cultivation on that particular plant. Most of the Egyptian varieties of cotton have been developed from plants such as those found by observant cultivators. It is said that a single oat plant found growing in a potato field in Scotland was the original of the popular potato oat which at one time had such a wide vogue.

Methods 4 and 5.

Methods (4) and (5) may be taken together. They are of great use to the scientist and horticulturist. New varieties of potatoes are raised from seed instead of planting the tuber, whilst date palms are raised also from seed instead of planting the suckers. In grafting we take the bud from one tree to another to work out our own ends in the improvement of the produce.

(6.) By Cross-Fertilisation or Hybridisation.

Our greatest hopes in plant development are focussed on this method. An ordinary planter could not be expected to carry it out, so little space will be devoted to it. Just as breeders of live-stock will cross a Shorthorn bull with a native cow, so plant breeders develop hybrids from two different plants. In this way they hope to combine and fix the best qualities of both plants in a single specimen. In every part of the world much work is being done on this method of plant improvement as its possibilities are so great. Even the good properties of some weeds are being utilised, and it needs little imagination to picture what might be accomplished by systematic and judicious plant breeding. In America crosses are being tried between Sea Island and the Upland cottons, and also with the Egyptian varieties, whilst in India the native varieties of cotton are being crossed with the better exotic varieties.

In Great Britain a wonderful work has been done on this subject with grasses and cereal crops. It has been thought advisable to include an abstract of an article which gave full details of the methods adopted by the best growers of Sea Island Cotton. This description was from the able pen of Professor Herbert J. Webber, the Physiologist in charge of the Laboratory of Plant Breeding, U.S.A. Department of Agriculture, and the summary printed below is taken from the Khedivial Agricultural Society's Journal, and was written by George P. Foaden, Esq., Secretary of the Society.

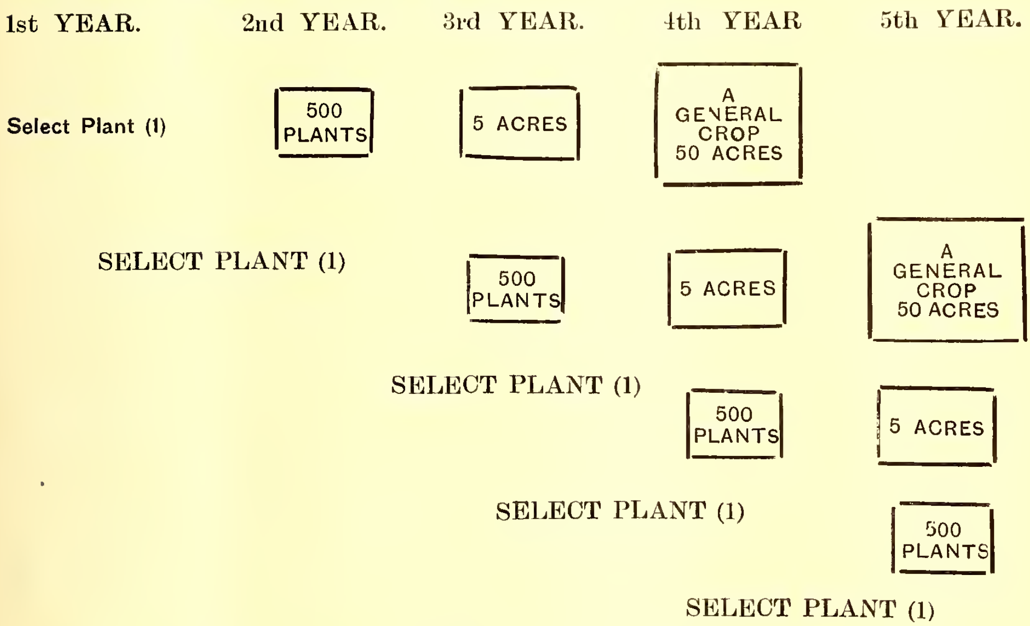
"In the selection of seed for cotton we have two primary objects in view, viz., to obtain the greatest yield and the best quality. To select for both objects at the same time is quite possible, though we think that the main object in view can be accomplished by growing in the first place the very best seed obtainable, and then selecting seed from the heaviest yielding plants, provided the quality of those plants is equal to the best standard of that variety. In the system of selection adopted by Sea Island planters most distinctive results have been obtained. For example, one grower's ideal has been to obtain heavy yields with but a secondary regard for quality, and this has been quite successful, the grower's cotton being known in the market as that from heavy yielding plants but whose quality is not "extra." Another planter again has selected for quality only, and though yield has been to a certain extent sacrificed, yet his cotton is sold for a much higher price. Thus starting with the same seed, two different ideals may be reached according to the wish of the particular grower. As a rule, however, our primary object is to increase the yield, and while striving to obtain this we have to see that we do not sacrifice quality and other desirable characteristics, but keep them at least up to the best standard. An area of the variety under consideration is planted with the best seed obtainable, and should possess a good soil and be thoroughly cultivated and manured in order to obtain a good development of the plants, and consequently ideal conditions for making selections. Just before the first picking, when some of the lower bolls are well open on all of the plants, the field should be gone over and every plant examined with reference to the productiveness, number and size of bolls, vigour and shape of plant, earliness, etc.

It is desirable to mark more plants than are expected to be used, because, in going over and comparing the plants the first time, it is ordinarily found difficult to carry the characters desired in mind with sufficient accuracy to enable a careful judgment to be made. Therefore some fifty of the plants should be first marked and numbered, so that these can be more carefully examined a second time and the number reduced possibly one-half or more. The permanent numbers should be placed only on the plants which are finally selected. Before each picking, a careful man should go over the field and pick the cotton from each plant in sacks numbered to correspond with the numbers on the plants, in order that the different pickings from the same plant may be kept together. Later on, after the close of the picking season, the seed cotton from each individual plant can be more carefully compared and weighed, and any of the plants which are found to have fallen below the standard in production or in any other important feature should be rejected. The remainder should be ginned, care being taken to have the gin thoroughly cleaned out before beginning the process, so that the seed from the selections will not become mixed with ordinary seed. After ginning each individual plant, the seed should be carefully picked up and replaced in the numbered sack, so that all of the seed from the same select individual will be retained by itself. In describing the method of procedure, it is much clearer to base the explanation on the assumption that only one plant is chosen which will make our explanation more clear, and what can be done with one plant can be done with any number. Twenty-five or more are selected in practice.

SECOND YEAR'S SELECTION.—The seed of the individual plant selected the first year is planted the second year. Each cotton plant yields from 500 to 2000 seeds, and therefore 500 or more seedlings will probably be produced from each plant. When these plants reach the proper stage of maturity, the entire progeny should be examined to see whether the plant selected the first year has shown strong transmitting power. If a large percentage of the progeny possesses the desired qualities in a marked degree, showing that the transmitting power is fairly strong, several selections of the best plants should be made from among them. If, on the other hand, the transmitting power has been weak, the qualities for which the plants were selected not having been transmitted, the entire progeny should be discarded. The possibility of having to discard the entire offspring of a select individual is the principal reason for urging that a number of selections be made the first year instead of only one or two. The specially selected plants of this second generation should be carefully examined with reference to the particular qualities desired, and a single plant finally selected which is superior to all of the others. The seed of this individual should be preserved separately, and handled exactly in the same way as the selection made the first year. The seed from the remaining plants produced by the single individual selected the first year should be ginned separately in order to avoid mixing, and retained to plant a seed patch of about 5 acres the third year, in order to obtain sufficient seed of a select strain to plant a large area the fouth year. That is to say from each plant selected the first year sufficient seed will be obtained to plant five acres the third year.

"THIRD YEAR'S SELECTION.—The seed from the plant selected the second year is planted by itself the third year. Just before the first picking, all of the progeny should be examined, as in the second generation, to determine the strength of the transmitting power. If the progeny as a whole are found to have inherited the characters of the plant selected the second year, a few of the very best plants should again be selected and marked as previously. These should be more carefully examined, as in the above instances, and a single superior plant finally selected. The seed of the remaining individuals from the same number as the one selected, which will be about 500 in number, should be retained to plant a seed patch the fourth year to give sufficient seed to plant a general crop the fifth year. The seed obtained in the third year from the seed patch of five acres planted from the progeny of the selection of the first year will this year furnish sufficient seed for the general crop the fourth year.

FOURTH YEAR'S SELECTION.—The seed from the specially selected plant of the third year is planted by itself and marked plainly to distinguish it from other selections, as in the previous year. From the 500 or more seedlings resulting, a particularly fine individual is again selected for further breeding, as in the preceding years, the same care being taken to determine the transmitting power to see that this is up to the standard. The other plants grown from the individual specially selected in the third year will this year give sufficient seed to plant a five acres seed patch the fifth year. The seed used to plant the general crop of the fourth year is that from the seed patch of the third year, grown from the unselected plants of the second year, and thus the general crop the fourth year is derived directly from the plant selected the first year, and so on through succeeding generations. The diagram illustrates the above method of selection.



Necessity of Selecting more than One Plant.—It is highly important in practice to select more than one excellent plant, as it not infrequently happens that a very fine plant is found having poor transmitting power, so that the progeny will be even below the general crop of the year preceding. It is impossible in a short article to lay out a general plan which will fit all cases. If the plantation is of moderate size, a sufficient number of individual plants could be selected each year, so that instead of the five acres seed patch represented in the diagram, the entire plantation could be planted the third year. According to this scheme, five plants selected the first year would in the third year plant 25 acres, and if 20 plants were selected the first year, they would plant 100 acres. It is thus within possibilities, on a moderate sized plantation, to select enough plants each year to plant the general crop from select seed the third year. The diagram illustrates the method of selection pursued by planters of Sea Island Cotton on James and Edisto Islands.

This description and diagram show that after the selection work has commenced, special selections are made each year from the small areas of very select seed, and that the main area is continually grown from seed descending from a single selected individual plant. Consequently in this system, the selection of the individual plant each year is considered. In practice, however, a grower selects several plants each year from which to breed. It is seen therefore that the quality must improve year by year, and this has gone on with Sea Island planters until a very high standard of excellence has been reached. The writer in fact was informed that 40 or 50 dollars per 100 lbs. were sometimes obtained for the finest grades of cotton from such selected plants when ordinary Sea Island was selling for half this price. We are quite aware that such a system of selection is entirely beyond what can be expected in Egypt, but it has been given here to indicate to Egyptian cultivators what steps are taken not only to keep up, but to improve the staple of Sea Island cotton. If such a system cannot be realised in this country by individual growers it should be put into practise on their behalf, that is to say seed areas should be set apart for the purpose and the grain placed at the disposal of careful cultivators who would in their turn produce seed for general use."—*B. C. African Gazette.*

EFFECT OF PLANT-GROWTH, AND OF MANURES, UPON CARBONATE OF LIME IN THE SOIL.

An interesting paper upon the changes which take place in the amount of carbonate of lime (chalk), which are brought about by natural agencies, by manuring, and particularly by the growth of plants, has been contributed to the Royal Society's Proceedings by Messrs. A. D. Hall, M.A., and Dr. N. H. J. Miller, of the Rothamsted Experiment Station. Since Cavendish discovered that carbonate of lime dissolves in rain-water charged with carbonic acid, and ascertained the presence of bicarbonate of lime in many natural waters, it has been recognised that the carbonate of lime (chalk) present in most soils must be subject to regular loss.

As the soils of the Rothamsted experimental plots and the drainage waters collected from the plots afford peculiar facilities for the study of this important question, they have naturally formed the foundation of the investigations by the authors. The natural surface soil on the Rothamsted Estate, and in Hertfordshire generally, contains little or no carbonate of lime, but during the eighteenth century and earlier very large quantities were applied artificially until it formed 5 per cent. or so of the surface soil. The method adopted was to sink pits through the clay to the chalk, which was then lifted and spread in considerable quantities. And the most experienced Hertfordshire farmers agree that chalking of lands so circumstanced is the best mode of culture they are capable of receiving. This earbonate of lime is being gradually dissolved out by the rain water percolating through the soil, and the loss will amount to about 800 lbs. to 1,000 lbs. per acre per annum.

The rate of loss is increased by the use of sulphate of ammonia, and is diminished by the use of nitrate of soda or organic debris like farmyard manure. The normal growth of crops tends to restore a certain amount of carbonate of lime and other bases to the soil, because the plant in feeding upon the neutral salts dissolved in the soil water takes more of their acids than of their bases, leaving behind a basic residue combined with carbonic acid excreted from the plant roots.

With ordinary agricultural and horticultural crops the restoration of bases must be considerable, probably supplying sufficient base for the nitrification process which is always going on. This explains why many soils containing little or no carbonate of lime (chalk) remain healthy under ordinary cultivation, provided that acid manures like sulphate of ammonia or superphosphate (especially the lower grades) are not used on them.

These researches also explain one or two other points which have been observed in connection with the use of nitrate of soda as a manure. It has long been noticed that the continued use of nitrate of soda is very destructive to the texture of a clay soil, intensifying all the clay properties, rendering the soil persistently unworkable when wet, and forming hard and intractable clods when dry. The ultimate cause of such an effect is the "deflocculation" of the fine particles composing the soil; they are no longer bound together in loose aggregates, but are separated so as to give the soil its most finely grained character. The deflocculation is much diminished where superphosphate (an acid manure) is used in conjuction with the nitrate of soda.—*The Gardenrs' Chronicle.*

MISCELLANEOUS.

Literature of Economic Botany and Agriculture VII.

By J. C. Willis.

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AGRICULTURAL BANKS FOR CEYLON.

BY E. S. W. SENATHI-RAJA.

It is a common complaint against young Ceylonese of the present day, that while most of our educated youth are anxious to get admission into the ranks of the learned professions which are already overcrowded, or to secure Government appointments which are, of necessity, very limited in number, few, if any, turn their attention to agriculture. The complaint is not groundless, for the fact is quite patent to all who have studied the progress of the native communities of Ceylon. But a mere superficial observer is apt to run away with the idea that it is simply due to native indolence or disinclination to engage in any employment involving physical labour, or to some supposed lack of dignity in the occupation itself. But such a conclusion, however, is erroneous. Agriculture has been the chief business of our people from time immemorial, and there is, so far as I am aware, no prejudice against the cultivation of the soil. But the causes which have led the educated youth of Ceylon to hanker after Government service or rush to the learned professions are not far to seek. From the day of the British occupation of Ceylon until about 20 years ago, the learned professions were to the average young men of the country, considering the paucity of the means at their command, far more lucrative than the cultivation of the ground. The form of agriculture which their means permitted, and which the tradition of centuries had familiarised them with, was chiefly the cultivation of rice, and that, as practised in Ceylon was seldom remunerative. The learned professions gave until recently a much larger income than the cultivation of rice, and even minor appointments under Government were far more profitable. It is no wonder then that our youth sought the more lucrative employments in preference to the old form of agriculture. But the pressure of competition, however, is making itself felt now more than ever, and there are scores of young men at the present day who will devote their energies willingly to the cultivation of the soil with the new products which are said to be remunerative, if there are reasonable prospects of earning a competence by that means. Even the villager seems to be stirred up by the enthusiasm shown by His Excellency the Governor and the Agricultural Society, to turn his attention from the time-honoured rice and chena cultivation, to the more tempting enterprise of planting new products. But there is one serious obstacle in their way, and that is the want of *capital.* Thanks to the present policy of the Government aided by the extension of railways through the waste and uncultivated tracts of the Northern, North-Central and North-Western Provinces, land fit for the cultivation of such products as rubber, cotton, ground-nut, tobacco, etc., may be said to be within the reach of every young man of energy, pluck and perseverance. But the cultivation of the earth, especially when it happens to be covered with primeval forest or jungle, requires a considerable outlay of capital, in the first place, to prepare the ground for cultivation, and secondly, to support the labourers engaged in the cultivation till the soil yields its return. In some cases, one has to wait for an income for several years, which are not merely a period of waiting but also of spending money. Where is the capital to be found?

The problem of native agriculture in Ceylon where new products are concerned, and indeed even for the better cultivation of old products, may be said to be substantially a problem of finding the capital to work with. Of the three economic elements of wealth, Land is at hand, and Labour is available, but the third element, Capital, is wanting. Until that problem is solved, it need hardly be said, the agricultural progress of Ceylon must be slow and unsatisfactory, and cannot be considered to be on a sound basis. Some men who have been lucky enough to make a fortune by arrack renting or plumbago mining or gem digging, may now and then indulge in the luxury of cultivating new products, but the people generally will continue as heretofore sunk in ignorance and debt, and follow the primitive methods of their forefathers; and educated young men will neglect agriculture, and turn their attention to something more practicable, until the problem of Capital is solved for them once for all.

Leaving aside the case of educated young men, let us look into the condition of the ordinary farmers and landlords of the country, men who are the backbone of society, men, without whom no Government can exist. Isolated from the rest of the world, ignorant alike of business-methods and modern systems of cultivation, exploited by usurers and fleeced by native headmen, their lot is indeed a pitiable one. The great majority of them are heavily indebted, and indeed it seems a solemn mockery to preach to them the manifold benefits of Western agriculture, to recommend to them the introduction of new ploughs and other implements of agriculture, the employment of artificial manures to fertilize their lands, and superior class of cattle to improve their existing breed, or to insist on the necessity of adopting proper methods of drainage and cultivation, without first helping them to obtain the indispensable Capital at cheap rates of interest.

According to statistics supplied by the Registrar-General the total value of registered mortgages for the year 1903 is more than Rs. 23,000,000, and it may be safely assumed that the unregistered mortgages are of equal value, and their sum total gives a fair idea of the indebtedness of landlords and farmers, who have lands to give as security. What debt there is on the security of movables and promissory notes it is impossible to say in the absence of statistics, but there is every reason to believe that indebtedness on those securities is an equally large amount. So then the total indebtedness of people who own movable or immovable property in Ceylon may be laid at the lowest calculation at about Rs. 80,000,000. From enquiry in different parts of the country and from the cases that come before the Courts, I have ascertained that the rate of interest on loans given on the security of movables and promissory notes is between 18 and 60 per cent, according to the status and credit of the borrowers. What industry or cultivation is there capable of leaving a margin of profit after paying such usurious rates of interest?

I have been induced to prepare this paper in the hope that the Agricultural Society of Ceylon which has come into existence under the auspicious patronage of His Excellency the Governor, will devise some method of solving this problem, —the rock on which many a promising association has stranded before this. If the present Agricultural Society of Ceylon is to go on in its career of usefulness, if there is to be permanence and continuity in its efforts to improve the methods of cultivation, if it is to be hereafter something more than a debating society, experience has shewn that it should tackle the problem at once and place it on a firm footing for ever. The native, though proverbially a conservative man, is yet a shrewd man, and he is eminently practical. Once shew him that tangible and profitable results can be obtained by the methods advocated by the Agricultural Association, and that this Society will help him to get money necessary for the improved methods of cultivation on easy terms and at cheap rates of interest, his faith will be quickened, and agriculture in Ceylon will receive an impetus which it never had since the days of the ancient Kings of Ceylon. The problem is, however, not an insoluble one, for there are other countries which were situated in a position similar to ours at some period of their national progress, but which have worked out the matter for themselves with conspicuous success. There is no reason, therefore, why the Agricultural Society which enjoys such exalted patronage, and which counts among its members almost all the high officers of the Government—the pick of the Civil Service—and a considerable number of the leading inhabitants of the Island interested in agriculture, should not solve the problem for Ceylon with equal success. It will be interesting therefore to see how this problem has been solved in other countries.

AGRICULTURAL BANKS IN SCOTLAND.

The country which affords the greatest parallel to Ceylon of the present day economically is Scotland in the latter part of the 18th century. Scotland was in those days a poor country, and the people were illiterate and ignorant. The labouring classes were poverty striken and miserable. Lawlessness was rampant everywhere, and the Scotch were as notorious in those days as cattle-lifters as the Sinhalese are at the present day. Large tracts of land in every part of the country lay waste and uncultivated. There was not enough money in the country either to open up the lands for agriculture or to construct public works. But the present state of Scotland is a marvellous transformation from what it was 150 years ago, and this wonderful progress was entirely due to the system of cash credit introduced by the Scotch Banks. A 'cash credit' is a drawing account created by the Bank in favour of a customer, upon which he may operate in the same manner as an ordinary banking account. A person who applies to a bank for a cash credit is called upon to produce two or more competent sureties who are jointly bound, and after a full enquiry into the character of the applicant, the nature of his business, and the sufficiency of his securities, he is allowed to open a credit, and to draw upon the bank for the whole of its amount or for such part as his daily transactions may require. To the credit of the account he pays such sums as he may not have occasion to use, and the interest is charged or credited as the case may be.

'Cash credits' are of two sorts, viz., (1) those given to private persons to help them in their business, and (2) those given to promote agriculture or public works. As regards the first kind of cash credit, it is said that almost every young man commencing business in Scotland begins even now by means of a cash credit. Solicitors, Writers to the Signet, and other professional men are, it seems, given small advances to start them in business on the guarantee of two or more sureties. All classes of society, rich as well as poor, are freely given cash credits, provided they are men of high character. In the evidence given before a Committee of the House of Commons, Mr. Monteith, M.P., stated that he was a manufacturer employing at that time 4,000 hands, and that he began the world with nothing but a cash credit.

When the Scotch first turned their energies to agriculture about the middle of the 18th century, the banks in Scotland had the right of issuing notes of their own, and they had habituated the people to receive their notes as money. Finding that there was much scope for agriculture in all parts of Scotland, the banks opened branches in every important centre and sent everywhere cartloads of their pound notes. The landholders anxious to improve their lands gave long leases to farmers. Upon the security of those leases and upon that of personal sureties, the banks granted cash credits to farmers. The advances were made entirely in the pound notes of the banks, and as the banks were very strongly constituted, their notes were universally received as cash. With these notes the farmers employed labourers to reclaim the land, and in a few years "bleak and barren moors were everywhere changed into fields of waving corn." With the produce of the fields, the farmers gradually repaid the loans, and reaped large profits themselves.

As for public works in Scotland, money for every description of them has been raised by the system of cash credit. Canals, docks, harbours, roads and railways have all been made in the same manner, and the debts were discharged by the profits arising from the public works. The Forth and Clyde Canal was, it is stated, constructed by means of a cash credit of £40,000 granted by the Royal Bank.

These cash credits are, it is to be remembered, not meant to lie idle, but they are constantly operated upon by paying in and drawing out. It was stated in the evidence given before a Committe of the House of Common (in 1826) that on a cash credit of a thousand pounds, operations to the extent of fifty thousand pounds took place in a week. It was also elicited that on a cash credit of five hundred pounds operations to the extent of seventy thousand pounds took place in a year. One witness stated that in a small country bank operations had taken place to the amount of ninety millions during a period of 21 years, and that the whole loss of the bank during that period did not exceed twelve hundred pounds. It was declared that at that time, there were twelve thousand cash credits guaranteed to persons in Scotland, and that there were 40,000 persons bound as sureties—persons who were interested in the integrity, prudence, and success of the others, for the sureties (cautioners as they are called in Scotland) keep a watchful eye on the proceedings of those for whom they stood security, and have always the right of inspecting their accounts with the bank, and of stopping it at any time if irregular. The witnesses before the Parliamentary Committee declared that the effects were most remarkable on the morals of the people.

"All these marvellous results," says an eminent Scotch writer, "which have raised Scotland from the lowest depths of barbarism up to her present proud position in the space of 150 years are the children of pure credit." It is no exaggeration but a melancholy truth that at the period of the revolution in 1688 and the establishment of the Bank of Scotland, that country, partly owing to a series of disasters as cannot be paralleled in the history of any other independent nation, and partly owing to its position at the very outskirts of civilisation, and far removed from the humanising influence of commerce, divided into two nations aliens in blood and language, was the most utterly barbarous and lawless country in Europe. And it is equally undeniable that the two great causes of her rapid rise in civilisation and wealth have been her systems of national education and banking."

"Her system of banking has been of infinitely greater service to her than mines of gold and silver. Her banking system has tended immensely to call forth every manly virtue; mines of the precious metal would probably have demoralised her people. In the character of her own people, in their steadiness, their industry and their honour, Scotland has found wealth infinitely more beneficial to her than all the mines of Mexico and Peru. The express purpose of these banks was to create credit, incorporeal entities, created out of nothing for a transitory existence, and when they had performed their functions, vanishing again into nothing from whence they sprang."

LAND BANKS IN GERMANY.

The method in which the continental nations have solved this problem of finding capital to improve agriculture is quite different to the cash credit system of Scotland. The first attempt at creating a land bank was made in Prussia, and the inventor was a German merchant called Buring. At the close of the seven years war in 1756, the land owners of Silesia found themselves in a great strait. The ruin and desolation caused by the war gave rise to general distress among landed proprietors. Interest and commission rose so high that they were unable to meet their engagements, and Frederick the Great issued a decree suspending the payment of all interest on estate debts for three years, and a subsequent decree extended it to a further period. It was at this time that Buring came forward with his system of raising money on land credit. The system of Government Funds, suggested to Buring the idea of creating a similar species of land stock. Governments, as we all know, can always borrow much cheaper than landlords, because the title is indisputable and the securities are far more valuable than those of private individuals. So there is no impediment to the negotiability of Government paper. Buring therefore conceived the idea of substituting the joint guarantee of all the proprietors of land for that of individuals, and establishing a book in which the Land Stock should be registered, and be made transferable, and have the dividends paid, exactly in the same way as in the Public Funds. *The credit of the Association was therefore always interposed between the lenders and the borrowers.* Those who bought the stock looked only to the Association for the payment of their dividends, and the borrowers paid all interest to the Association which took upon itself all questions of title and security. The whole of the obligations were turned into stock transferable in all respects like the Public Funds. The first land bank (Landschaften) on the model suggested by Buring was established in Silesia in 1756 by the fiat of King Frederick the Great. The usefulness of these banks became so great and so universally recognised that they were introduced in quick succession into other countries. According to Monsieur Josseau, they were introduced into Brandenberg in 1777, Pomerania in 1781, Hamburg in 1782, West Prussia in 1787, East Prussia in 1788, Luneberg in 1791, Esthonia and Livonia in 1803, Schleswick-Holstein in 1811, Mecklenberg in 1818, Posen in 1822, Poland in 1825, Kalenberg, Grubenhagen and Hildsheim in 1826, Wurtemberg in 1827, Hesse Cassel in 1832, Westphalia in 1835, Gallicia in 1841, Hanover in 1842, Saxony in 1844 and France in 1852.

All these banks do nothing more than convert mortages into stock, and none of them is said to issue paper money. They make advances from one-half to two-thirds of the estimated value of a property, in small bonds varying from £5 to £100 bearing interest from $3\frac{1}{2}$ to 4 per cent. The bonds are transferable by endorsement or delivery. Every six months the fixed dues which include interest and sinking fund are paid in by the borrowers. The sinking fund, which reduces the principal debt by small instalments, begins at half per cent and gradually increases each half year as the principal is paid off and as the charge for interest therefore decreases. Every proprietor has a right to a loan according to the value of his property. The holder of the bonds has as security for their payment the whole capital of the bank plus the lands specially mortaged to the bank. The borrowers may pay either in money or in the bonds of the company which they may purchase from the public. These land banks have had the most marvellous effects in developing the agriculture of the countries in which they have been formed, exactly similar to the cash credits of Scotland. What is most remarkable about the bonds of the land banks is, that in times of panic caused through war, revolution, or monetary crisis, they have maintained a steadiness of value beyond all other securities, not excepting Government Stocks. Monsieur Josseau, to whose book I am indebted for much of the above inormation, says that in the revolutionary period of 1848, while the Prussian funds fell to 69, shares of the Bank of Prussia to 63, and the shares in railroads from 30 to 90 per cent, the bonds of the land banks producing $3\frac{1}{2}$ per cent interest stood at 93 in Silesia and Pomerania, at 83 in West Prussia and at 96 in East Prussia! The reason is not far to seek, for in times of revolution or war, Governments may disappear or States may become bankrupt, but the lands, the stock in trade of the land banks are there always as immovable as ever.

(To be continued.)

AGRICULTURE IN THE KADAWATA AND MEDA KORLES.

By S. D. Mahawalatenne.

The Balangoda district, comprising Kadawata and the Meda Korles, a chief Headman's division, is about 300 sq. miles in area with a population of about 22,536 Sinhalese and 5,891 immigrant Tamils, distributed about 25 to the sq. mile. In 1901 when the last census was taken we had 7,988 employed in agriculture, 500 in commerce, 46 in the manufacture of earthenware, 61 working in metal, 23 in jewellery and 118 in other manufactories. These figures exclude the Tamil coolies

11,940 acres of paddy fields and 3,210 acres of high land for dry grain were cultivated, which yielded a gross produce of 157,839 bushels of paddy and 16,650 bushels of other grain. The average was 5-fold and 12-fold respectively. When this gross produce was converted into food stuff it was about 94,919 bushels. The quantity of food required for the resident population is about 261,360 bushels and 111,120 bushels for the immigrants, totalling up to 372,480, and it is estimated that the deficiency of food produce locally grown is about 277,561 bushels. At the rate of Rs. 5 per bushel the district consumes about Rs. 832,205 worth of imported rice and Rs. 555,600 worth of rice for the Tamil coolies. In all Rs. 1,387,805 worth of imported rice per annum, and this in a country eminently suited for agriculture, with a resident population who are agriculturists by birth, by habits and training, as well as by caste and religion. The cause for this deplorable deficiency in the production of food deserves to be carefully investigated, and that early. I will not presume to say what the causes are. I think the Agricultural Society can and will investigate the causes, and lay before Government a scheme to remedy them. The rainfall has annually decreased since 1896, in which year it was 108·61, which was an increase of 11·22 on that of the previous year. In 1897 it was 84·04; in 1898, 60·19, in 1899, 73·44 and in 1900, 72·34. Ever since then it has not gone up, and to-day of the vast extent of paddy lands in the district nearly three-fourths of those annually cultivated for the 'yala' cultivation are lying dry and bare for want of rain. The fate of the people depending on the produce of these fields can better be imagined than described. The scarcity of rain alone is responsible for the non-cultivation of the paddy fields and if scientists are to be believed it is the destruction of forests that has caused a decrease in rainfall. The rubber boom will destroy many more forests than the tea boom did and render the country drier. It would, I think, be to the interest of Government and every individual in general to let the forests alone and carry on operations in lowlying chenas alone. It would be as well to acquire all forests at high elevations and preserve them for the conservancy of the rainfall. The decrease in food produce is telling fearfully on the people. Those who are present at the meeting to-day may appear to be healthy with no sign of starvation on them, I admit, but what is the proportion of those present to-day to the total population of the district? One must go to a village and live there for a number of days to know the actual misery prevailing there. The state of a few in a community is no criterion of the state of that community. If Government were actually fully aware of the general condition of the villager, how he is suffering from diseases and from want, there is not the least doubt that a great deal more would be done for him than what is being done to-day; for it will be the height of ingratitude to say that nothing is being done. A great deal has been done, and a great deal is being done, but what I say is that a very great deal more has to be done before we can say that we have arrested the steady course of the extinction of a very interesting race of men. We are fully aware of the fact that a benevolent Government like the British Government would do anything and everything to ameliorate the condition of its subjects, but from past history it would appear that there have been periods often recurring during which nothing has been done either to improve or extend agriculture. Perhaps more unrestricted expenditure on irrigation works, the quick settlement of land claims, unstinted help and encouragement to the goiya, and above all protection against the merciless usurer might improve the condition of the masses depending on cultivation.

I have often heard it said that the Sinhalese are a lazy lot—apathetic, indolent, unenterprising and unindustrious; I take leave to differ from that view. If the labour a Kandyan goiya spends on his paddy field and on his chena is fairly estimated, I think that false impression will at once be removed. He is neither lazy nor indolent, but he is to a certain extent unenterprising. He has to be led, he has to be educated. He knows exactly what amount of labour will supply him with food for the ensuing year, and he is content if he can raise that. By nature he has no trade instincts, and he raises food for consumption, and not for sale. He has to be taught that that state of things, although it answered well in the past, will not do to-day. He has not only to be taught but he has to be forced to suit himself to the times. He has been used to be thus forced to do things good for himself in the long past, and a habit thus inherited will not disappear for a long time to come. Therefore it would not be an unjustifiable act if Government were to adopt measures to make the villager work more in his own interest in extending and improving his cultivations. The maxim—"Interference with the liberty of the subject" will not apply in the treatment of a people like the Kandyan peasant. He is so simple, so ignorant, and so conservative, that he would not do anything that would bring him a fair amount of remuneration until he has seen for about the hundreth time that others have done the same thing and have been fairly remunerated. With these few prefatory remarks I will proceed to give a brief description of our school gardens and experimental gardens, and what success they have achieved in the past.

MAHAWALATENNE EXPERIMENTAL GARDEN.

In the year 1891 when I went on circuit in the district of Kadawata and Meda Korles as the R.M. for the first time, I visited the very few schools it then had. The plots of land attached to the schools were bare, and on my suggesting to the teachers to plant them up, they pleaded all sorts of difficulties such as want of tools and objec tions on the parts of the parents of the boys to allow the latter to work. I saw numbers of boys who had left school idling in the villages not doing any work, probably thinking that 'govitena' was a humiliating work after a school career. This is the villager's boy—the hope of the future of the village—the strength of the country. Of an evening these youths with handkerchiefs thrown hanging over their shoulders, cigar in mouth, promenade the village paths admired by the village lasses, no doubt, while their strong sturdy fathers plough the fields, or gather in the harvest silently sighing at the demoralization of the sons owing to the school education given them under compulsion. They would not have willingly sent them to school, but their Chief and their Government Agent told them under pain of punishment that the boys must be sent to school which would make them good men. In blind faith they obeyed, and the result was that instead of good men the schools turned out a lot of lazy good-for-nothings living on the hard earnings of the fathers. Besides, the boys being a tax on the fathers, the latter even had to pay the road tax and the Gansabhawa tax to Government for the former—for school education has made the boys unfit for manual labour. That was the state of things here in 1891. I approached the prominent men among the villagers, and persuaded them to consent to the boys working in the gardens for a short time daily, and obtained the permission of the Government Agent to supply garden implements out of Gansabhawa funds, and started a few school gardens. In 1892 I opened up a garden myself near my residence, in which I used to get all the village boys and children of my tenantry to work, and to encourage them, and to show them that manual labour was in no way a mean occupation, I used to work with them myself for a short time. The garden was a success which encouraged me to approach the then Government Agent, the Hon'ble Mr. Wace, the friend of Sabaragamuwa, with a request for an experimental garden and for a school for Mahawalatenne. Readily he granted my application, and soon after an Agricultural Instructor was appointed to the Balangoda school and a boys' school opened at Mahawalatenne. The Teacher as well as the Instructor were industrious useful practical men. Neither of them are now alive I regret to say. At once I opened up a garden attached to the Mahawalatenne school at my own expense simultaneously with the experimental garden at Balangoda. The Government Agent a year after visited these on tour, and was so pleased at the success of the school garden that he on my application sanctioned the removal of the experimental garden to Mahawalatenne. The Government Agent, at his own expense, procured seeds for us, and I did the same. We distributed large quantities of seeds and plants of many varieties among the villagers, and our work was steadily progressing when the Instructor died. From that time we began to decline. We were given as the late Instructor's successor a sort of dandy and a sportsman, who would not budge an inch out of his cottage without his boots and gaiters and rifle. His successor was a madcap-preacher who was never happy unless he was engaged in open-air preaching. I believe he is in the lunatic asylum now. He was succeeded by the present Instructor, Mr. Silva, who, I am glad to say, takes a deal of trouble and works the garden well. We tried cinnamon and citronella which are flourishing indeed. The growth shows that in this country the soil and the climate are far better for cinnamon and citronella than in the low country. We tried cotton which, too was successful. We got out tobacco seed from America and grew a crop, but the leaves did not come all right. There were yellowish spots all over the leaf, and these spots were so thin that on drying they became so many rents, rendering the leaf perfectly useless. This was a failure. Then we tried ratatora, ground nuts and American maize. These were successful. The Instructor was made to visit the School Gardens periodically, and we supplied him with seeds and plants for distribution. The number of schools increased rapidly, and every one of them had a garden. The reluctance on the part of the boys to work and the parents to allow them to work disappeared, and it was pleasing to see that the majority of the boys actually had tiny plantations of their own in their fathers' residing gardens. The villagers themselves took to planting, and large quantities of vegetables were daily brought to town for sale. This is a result of the garden and the school gardens, and it is a satisfaction indeed. The only disadvantage is that during vacation when the teachers go to their villages there is no one to take care of the gardens. The Government Agent says the arachchi must look after the garden; but I know the difficulty and the expense the arachchi will have to undergo to do that, so these gardens will never be the success they will otherwise be. About the time I was agitating for more schools and experimental gardens, and for Agricultural Banks, for the repurchase of alienated villagers' lands, for introducing a system to regulate their cultivation on economic and profitable principles, for partition of lands held in undivided shares or under the Tattu Maru Tenure, introduction of new stock with a view to the improvement of the country breed, introduction of seed paddy from foreign countries, free distribution of praedial products, introduction of pasture lands, planting up communal gardens, the introduction of provincial agricultural shows and other improvements, I was informed of the Government's decision to close all the experimental gardens. I pleaded the case of our garden so earnestly, that Mr. W. E. Davidson, the then Government Agent, fought hard and secured the retention of the garden. It is the only one that was not closed, and I believe is the only survival of the gardens under Mr. Green's scheme. Now that we have the Agricultural Society and a Governor who is so keenly and greatly interested in the agriculture of the country, there is no fear but that in the near future we will be able to see vast and rapid progress. Speaking of the wants of this district only, I can say without fear of being contradicted that up to date although much has been attempted, we have done nothing to materially improve agriculture or the condition of the agricultural classes, or to remove the great disadvantages under which the peasant carries on his agricultural work. The villager now works as it were not for himself, but for the boutique-keeper or moneylender. All the profits from the fields go to pay the usurious interest at which seed paddy and other things are borrowed during the cultivation time, and at the end the land goes to repay th capital.

Lands belonging to 1,170 families have been sold up to 1891. Among these there are 1,434 paddy fields, 131 gardens and 5 houses. 115 of the original owners of these lands were in 1891 working as coolies under the new proprietors, 583 became common coolies and 97 became paupers. I submitted a proposal to the Government Agent, Mr. Fowler, to repurchase these lands and place the original owners on them as Government tenants on the ancient Indian ryot system. I then thought my proposal had his sympathy, but after he left the Province the matter was shelved. I beg to refer in this connection to the information given in the last Census Report. If the national character and conditions of the native peasantry is to be maintained, it is of paramount importance that their paddy fields should be prevented from changing hands. Even special legislation for the purpose will be justifiable. Knowing the great simplicity of the villager, his proneness to get into debt and to be caught in the meshes of designing land-grabbing villains, his incapacity to detect deception, and the ease with which he could be launched into litigation, I can with some authority say that in my opinion State interference to protect his paddy fields will be quite justifiable. Agricultural Banks which I have often advocated would to a certain extent free the "goiya." To stimulate the agricultural progress of a country, societies such as we have now, and experimental gardens here and there, and agricultural shows alone will not do. We must take up every question that has any bearing on agriculture, every question that would even in the least tend to render agricultural pursuits easy and remunerative. We must help the goiya and encourage him just as Government helps and encourages the merchants and the planters. Against this it may be said that the villager is not taxed. I admit he is not directly taxed, and I do, as I always did, deplore the abolition of the paddy tax. The day that step was decided on was the villagers' evil day. Partition of lands held in undivided shares and under the Tattu Maru tenure is also a question touching the agricultural development of the country. This tenure is a great drawback to the improvement of lands. Introduction of live stock, free distribution of seed of praedial products, and their enforced plantation deserves to be considered. There is no reason why people should not plant more coconuts and arecanuts. I think the Gansabhawa could make some arrangement to supply a good number of nuts annually for free distribution. There is no excuse why every village garden should not be fully stocked with fruit trees and other economic trees. The price of rubber seeds has gone down so much, and the rubber boom has almost reached its zenith, I do not see why Government with its overflowing coffers should not distribute a few dozen seeds to each villager to plant in his own garden. Unlike tea, rubber would suit the villager very well as coffee did in the happy past. Whatever may have been said, and whatever may be said about the unremunerativeness of paddy cultivation, paddy cultivation alone would keep up the Kandyan Sinhalese, and nothing else would suit the Kandyan more than this cultivation. Therefore it is to the improvement of paddy cultivation that the Societies should first direct their attention, and next to other cultivations. It should be the aim of the Society to see that every district turns out so much paddy sufficient for the consumption of its resident population. What district can boast of such a thing to-day? Kadawata and Meda had in 1901 a Sinhalese population of 22,149, out of which 7,988 were engaged in agriculture. 11,940 acres of paddy land and 3,210 acres of high land were cultivated which brought in 157,839 bushels of paddy and 166,500 bushels of other grain. These when reduced to food stuff would give 288,769 bushels or about 10 bushels per head per annum for a population of 22,149. Another 50,000 bushels per annum would render the supply sufficient for consumption only. But to render the supply sufficient for all the necessaries of life of the people it should at least be 25 bushels per head per annum, which would be 553,725 bushels, and the deficiency after deducting the present yield is 264,956.

7,988 persons cultivated only 15,150 acres or about 1¾ acre each which is very unsatisfactory. This is because we have not a sufficient acreage of paddy land, and because the irrigation policy has for some time past not been pushed on as vigorously and as boldly as it should have been. We want more irrigable lands. We have the lands and we have the water, but we want Government to step in and build the irrigation works. We cannot do it ourselves. The next most important thing is the cultivation of chena lands. The villagers have comparatively a small area, and in the past Government used to allow villagers to cultivate chena lands on tythe. Since of late for some reason or other this concession has been withheld. I have made a number of representations to Government, and I was told that chena cultivation was not profitable. Just a glance at the relative food producing powers of mud land for paddy and chenas will show that the cultivation of the latter is not so unprofitable. An adult requires about 3 lb. of food a day such as cereals and other vegetables. A bushel of rice is 64 lb. in weight or 2 lb. a measure. A bushel of kurakkan—chena produce—is 56 lb. in weight. For a month—30 days—an adult will require 90 lb. of food equal to one bushel and 13 measures of rice or 8 bushels and 19 measures of kurakkan. Besides the food a householder requires about 73·50 per annum for other expenses. On this calculation a family of one man, one woman and one child will require about 38 bushels of rice or 42 bushels of kurakkan and in cash about Rs. 148·50 per annum. Therefore, the total expenses of such a family of three persons will be Rs. 300 if it lives on rice and Rs. 203 if it lives on kurakkan, valuing a bushel of rice at Rs. 4 and a bushel of kurakkan at Rs. 1. The sustaining power of rice and kurakkan differs but slightly as will be seen from the above figures, and the analysis of kurakkan does not condemn it as a food. Now with regard to the food producing power. An acre of paddy land will yield about 24 bushels of paddy. The cost of cultivating an acre of paddy land will be about Rs. 29, and the produce 24 bushels valued at Rs. 38·40. In the cost of cultivating I included the cost of labour. An acre of chena for kurakkan cultivation would cost about a fourth of what an acre of paddy land would cost, and the yield will be about 10 bushels of kurakkan, and other grains and vegetables equal in quantity as food stuff to about five bushels. That is, an acre will yield 15 bushels of food stuff at a cost of about Rs. 7. Therefore it is not correct to say that chena cultivation is not remunerative. I was astonished to hear that. Who is the judge who pronounced that decision sentencing chena cultivation to the scaffold? I am unable to find out, but whoever he is I do differ from him in that most erroneous opinion of his, arrived at perhaps on a basis of calculation made under most arbitrary rules. No man who knows anything of the Kandyan and his mode of living, his habits, and his system of work and cultivation, can correctly and conscientiously say that chena cultivation is not of profit or use to the Kandyan. I would challenge anyone to prove that it is not profitable. The great decrease in food stuff I attribute to the policy of Government in withholding the concession hitherto enjoyed by the people. But I was always for regulating chena cultivation, and if the concession were to be renewed it should, I say, in the interest of agriculture in general, be on improved lines. It is to be earnestly hoped that these agricultural societies and gardens will not only improve the methods of cultivation, but be instrumental in inducing Government to open up more irrigable lands, and in general induce it to take up every question having the least bearing on agriculture and deal with these quickly but liberally.

In 1904 the Balangoda societies were established—the first meeting was held in March, but beyond that I could not do anything owing to the severance of my official connection with Government in June of that year. But from what I could see, I think there is a great future for these societies and gardens. They are now in younger and abler hands, and I do hope that progress and success are not far distant. The district feels thankful to the late Secretary of the Parent Association for his visit, for such visits at much personal inconvenience are indeed a great encouragement. Owing to the absence of the Agricultural Instructor I could not get at the papers relating to the garden, and I am unable to give more definite information regarding it. Last year and this year we have had unusual dry weather and our cultivations are practically nil. We grew some Italian potatoes very successfully and a few cabbages. The "Sixty-days" paddy is thriving well. I distributed the five bushels among villagers and I sowed some myself.

We want a well for the experimental Garden as well as quarters for the Instructor and the coolies. I think the Gansabhawa with some help from Government would be able to do these works. What I have to say more on the subject of agriculture in this district I shall reserve for a future paper.

Lessons in Elementary Botany. III.

By J. C. Willis.

We must now consider the ways in which the leaves are arranged upon the plant, or their *phyllotaxy*, as it is often called. This is by no means haphazard, as it may perhaps appear to be at the first glance, but follows definite rules, which for any one plant are practically always the same.

In a good many plants the leaves are what are still termed, in the language of the botanists of 150 years ago, *radical*, or spreading out simply at the ground (Plate II) as if from the top of the root. This may be seen in the common weeds of grass lawns and many other plants. In reality the root is crowned by a very short stem from which the leaves spring, but they look almost as if they came from the root. In most other plants the leaves are borne upon the stem above the ground, sometimes evenly spread out along it or along the part which has lately grown, sometimes crowded together at the end. They may be in pairs at each *node* (as the points where they are borne are termed), in which case one usually faces say North, the other South, and they are called *opposite* (Plate II), or there may be only one at each node (*alternate*, Plate II), or there may be more than two, arranged in a ring or *whorl* (Plate II).

Generally speaking the leaves are arranged to spread themselves out to the very best advantage in regard to sun and air, in such a way as to overlap and shade one another as little as possible. It is found by actual measurement that there is a constant angle (supposing there to be no twisting of the stem) between each leaf and the one next above. For instance, in grasses or bamboos this angle is 180° or half the circumference, so that the leaves are in two rows, one on either side of the stem. In many sedges the angle is 120° and the leaves get into three rows. But in most plants the angle is less simple and the number of rows in which the leaves stand may be 5, 8, 13, or any of the numbers obtained by adding together the two last written down (*e.g.*, the next number is 21, the next 34, and so on). The angles do not matter to us; the important thing is that the leaves are spread out in such a way as to shade one another as little as possible. In many trees and shrubs the arrangement on the twigs or branches standing more or less horizontally is different from that on the main stem standing more or less vertically, and the leaves on the former tend to get into two ranks, facing upwards.

In very shady places, as for example along the streams in most up-country jungles, the leaves can often be seen beautifully arranged in what is sometimes called a *leaf-mosaic* (Plate II) spread out so as to occupy every bit of space without overlapping. In many cases they will also be seen to be unequal (Plate II), usually those on the lower side of the stem larger than those on the upper side, but not always. The reason of this phenomenon has not yet been satisfactorily made out, but it is very common.

Leaves may have stalks or *petioles*, or have none (*i.e.*, be *sessile*), and these stalks, by being of greater or less length as needed, help very much in the construction of leaf mosaics.

The leaf itself is a thin green expanded organ in most cases, and is in a sense the most important part of the plant, as it prepares, from the materials coming to it from the roots (water and many substances dissolved in it) and from what it gets from the air, the actual food upon which the growing parts of the plant feed. The great bulk of a plant is made up of material derived from the almost infinitesimal amount of carbon dioxide gas in the air (the gas given out by animals and plants in breathing) by means of the leaves, and of water taken from the soil. The plant, in the enormous majority of cases, is absolutely unable to get water from rain by means of its leaves, or to get carbon from the soil even if the latter contain a good deal of it.

In order to absorb carbon freely from the air, the leaf in places where it is not too dry for such construction is very thin and spread out flat by means of stronger *veins* or *nerves* running through the green tissue. These veins run down to the base of the leaf and enter the stem. They are the channels by which the water from the root enters and spreads out in the leaves, and are very much ramified through the latter, so that every part shall easily get its water.

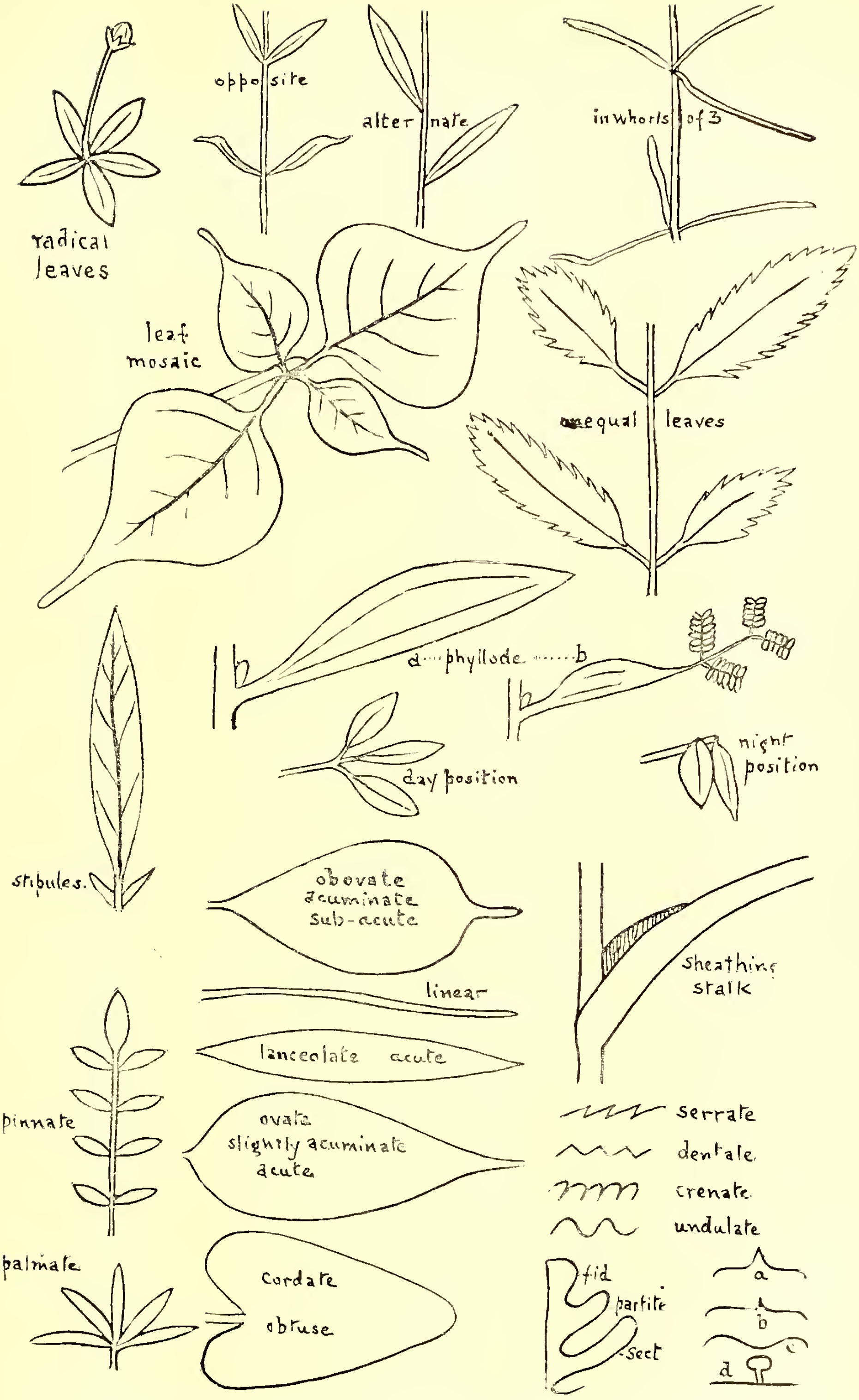
If the leaves are to be exposed to much sunshine, the very thin and delicate structure seen in so many leaves will not suit, and they are more leathery, as is seen for example in jak leaves.

Leaves when young can still move to some extent, and they in general take up what it is often called their fixed light position, arranging themselves so as to be at right angles to the brightest diffused light (not, as a rule, direct sunlight) falling upon them. In other words, they tend to be horizontal, but if, for example, the plant is placed in a window they will all grow to face the light, and stand at a considerable angle with the vertical.

What we have said refers to ordinary leaves, which are what is called *dorsiventral*, having a dorsal or lower surface and a ventral or upper, which differ in internal structure and usually in external appearance. Some plants however have their leaves the same on both sides, and these *isobilateral* leaves stand with their points or edges to the light, as may be seen in the Gladiolus, &c. In the Acacias and some kinds of Eucalyptus, *e.g.*, the blue gum, the leaf is replaced by an organ standing edgewise to the light and called a *phyllode*, which is really the flattened leaf stalk. Often intermediate stages (Plate II) can be found on the plant, the phyllode not being quite so large, and the leaf blade not having entirely disappeared.

Many leaves, especially in the plants of the family Leguminosae, to which peas and beans belong, *sleep* at night or in a hot sun. The sensitive plant, so common in the low country, also sleeps when touched, but few are so sensitive as this. Most of them, however, bend down their leaflets in various ways at night (Plate II), so as to turn their edges to the sky instead of their flat surfaces. The common species of Oxalis also show this very well.

(*To be continued.*)



LESSONS IN ELEMENTARY BOTANY--PHYLLOTAXY. PLATE II.

PLANT SANITATION.

Entomological Notes.

By E. Ernest Green, *Government Entomologist.*

Specimens of a Longicorn beetle (*Moechotypa verrucicollis*, Gahan.) have been sent in from the Matale district, together with examples of young rubber stumps said to have been killed by them. The bark of these plants has been nibbled off, in large irregular patches, exposing the bare wood. Similar specimens, under identical conditions, were received from the same district exactly a year ago. Examination of the roots prove that they have previously been attacked by the parasitic fungus, *Botryodiplodia elasticae*, Petch. This fungus attacks the collar of the plant; kills the upper parts by cutting off the supply of nourishment; and works down into the root. It has always seemed to me extremely doubtful that a healthy rubber plant, protected by the natural flow of latex, could be successfully invaded by bark-eating and boring insects, and the following experiments have strongly corroborated my theory. Several of the living beetles were confined in a large cage together with a healthy living plant of Hevea of the same age and stage of growth as those which were the objects of attack in the Matale district. The beetles crawled up the stem and presently tried their jaws on the bark. The puncture resulted in an instantaneous exudation of latex which adhered to the mouth parts of the beetles and was evidently very distasteful to them. They immediately abandoned the attack and spent some time in endeavouring to remove the sticky fluid. After the first rebuff no further attempt was made, even under stress of starvation. After seven days' confinement, with no other food, I then removed the beetles to another cage and provided them with some small branches of Cassia and tea. They commenced to feed greedily upon the bark of the Cassia, but the tea branches are not altogether to their taste. They have fed only sparingly upon the outer layers of the bark. These experiments clearly show that a healthy rubber plant is immune from attack. But should the latex tubes become dry, from disease or any other cause, the plants will fall an easy prey to boring and bark-eating insects. Stumped plants that have been despatched by rail for long distances and have become withered during transit, will be especially liable to attack.

Further specimens of young rubber stumps, the ends of which have been tunnelled to form a receptacle for the nests of a small Hymenopteron, have been received. (See note in February number of this journal.) The present specimens come from the Badulla district, and contain the nests of a tiny bee (*Ceratina* sp.). A considerable number of small wasps and bees have this habit of boring into the pith of dead parts of plants. The wasps usually store their nests with insects, while the bees provision theirs with 'bee-bread' (a mixture of pollen and honey). The following species have been observed to infest young rubber plants :—*Trypoxylon intrudens* and *T. pileatum* (provisioning their nests with spiders), *Stigmus niger* (with Aphides), *Odynurus sichelii* (with small caterpillars), *Ceratina simillima*, *C. viridissima*, and *C. propinqua* (with 'bee-breed'). Though none of these insects will attack the living parts of the plant, it is possible that the tunnel in the dried ends of the stump may form a lodgement for water and subsequently for injurious fungi. It is advisable therefore to cut off the dead ends of the plants, care being taken that the cut should be just above nodes (or knots) of the plant. If the cut is made through or just below the node, it is probable that a further section of the stem will die back.

A case of infestation of the stem of a Hevea tree by the 'horned Termite' (*Termes inanis*) has been brought to my notice. This species of termite takes advantage of any hollow in a tree for the construction of its nest, but does not apparently feed upon the wood itself. My observations lead me to believe that it subsists principally upon lichens growing upon the stems of trees and rocks. In the present instance the tree is still alive, the termites occupying a large cavity in the bole where the original stem had been broken off by the wind. I have recommended the removal of as much of the nest as can be reached without further damaging the tree. The more inaccessible portions can be treated with naphthaline dissolved in petrol which will drive out the remainder of the insects. The cavity should then be tightly plugged with *dry* earth.

The grub of the large Cockchafer (*Lepidiota pinguis*) continues to give trouble by feeding upon the roots of rubber plants. In some cases the tap root has been eaten right through. Kainit, and nitrate of soda are the recognized deterrents for this pest; but they must be employed carefully and not allowed to come into direct contact with the tender roots of the plants, or their caustic properties will cause further injury. The best method of application is to mix the substance with earth and spread it upon the surface round the plants. The first shower of rain will dissolve the salts and carry them down into the soil. For very young plants, one ounce of the nitrate or three ounces of the kainit will be sufficient per plant. For larger plants from one and a half to twice this dose may be safely employed. When the adult cockchafers are on the wing, they may be trapped by placing small kerosene lamps, in trays containing water and kerosene, in the field at night. During the daytime, the beetles may be found resting upon the stems and branches of plants and should be collected and destroyed. (For figures of the grub and adult beetle see *T.A.*, Oct. 1905, p. 520.)

I have made an interesting examination of samples of various shade trees containing galleries of the 'shot-hole-borer' (*Xyleborus fornicatus*). Young branches of *Albizzia moluccana* had been tunnelled by the insect, but the galleries were deserted and showed no signs of having produced a brood. The insect had evidently found this wood unsuitable for breeding purposes. The galleries were more or less filled by an exudation of gum. The same remarks apply to Grevillea branches, in which only a single living beetle (evidently a recent arrival) was found. Several dead beetles were found, enveloped in gum. Loquat branches had also been tunnelled; but here again there was no present occupation. A single dead beetle was found in one of the galleries. Under these circumstances, it would appear that though 'shot-hole-borer' may attack and—to a certain extent—damage these shade trees, it cannot successfully breed in them; and that such trees are not therefore of any real danger to the tea amongst which they may be growing. On the other hand, a section (4 inches in diameter) of the stem of an old castor-oil plant, from the same estate, was found to be badly infested by the borer. The numerous galleries penetrated deep into the wood, and contained living insects in all stages of development. It is evident that we have here a prolific breeding place of the borer, and that such plants would constitute a source of infection to the surrounding tea. Young castor plants will not be so liable to attack. It is only when they have been allowed to grow old and woody that they harbour the pest to any serious extent.

A correspondent asks if tar, applied to the stems and branches of tea plants, would prevent the invasion of 'Shot-hole Borer' (*Xyleborus fornicatus*) from neighbouring infected estates. He writes, "I have shot-hole borer all round me, but not—as far as I can see—actually on the estate." I have found a complete coating of tar very injurious to the tea plant. It burns the bark badly and—in some cases—has resulted in the death of the tree. Any application that is of the nature of an airtight coating must be injurious to such a plant as tea, in which the bark is *live* right to the surface. Under the circumstances detailed above, I should recommend the isolation of the estate—from its infected neighbours—by a thick screen of 'Dadaps' (*Erythrina lithosperma*) which are of rapid growth and do not harbour shot-hole borer. If, from the commencement of the planting industry, estates and individual fields had been separated from each other by effective screens of jungle or introduced trees, we should have had little trouble in confining and combating the pests which are now able to spread without let or hindrance. It is to be hoped that rubber planters will take warning from the difficulties experienced first with coffee and now on the large undivided areas of tea plantations.

Two species of 'Case-worms,' (*Chalia doubledayi*) and (*Acanthopsyche hypoleuca*) (see figs. 2 and 10 on plate facing p. 301 in the May number of this journal) are reported to have caused serious injury to a field of tea in the Gampola district. This same field was badly attacked last year also, and the trees so weakened that they have never properly recovered after pruning. Such weakened trees should be assisted with suitable manure. Paris Green would be the best treatment for this pest; but there are evident objections against the use of mineral poisons upon tea that is in plucking. I have suggested that lime and sulphur (dusted over the bushes) might act as a deterrent against the spread of the pest, but this cannot be relied upon to kill the caterpillars upon bushes already attacked. Collecting by hand, when the insects are in force, is almost useless. The newly-hatched caterpillars are very minute and inconspicuous. They are carried from field to field on the coolies' clothing. Case-worms have been unusually abundant, during the last two years, probably owing to the comparative failure of the usual rains.

Specimens of the Pyralid moth (*Dichocrocis punctiferalis*) have been bred from caterpillars infesting the seed heads of the Indian millet (*Sorghum vulgare*). The caterpillars were feeding upon the ripe seed, amongst which they had spun silken galleries. This species is the well-known 'pod-borer' of Cacao in Ceylon. It has also been bred from the seed-heads of the Castor oil plant (*Ricinus*).

I have received branches of the handsome flowering tree (*Amherstia*) thickly encrusted with a lac-insect (*Tachardia albizziæ*). The pest may be kept in check by the application of kerosene emulsion.

A correspondent sends me specimens of a small 'Flea-beetle' (*Hypnophila flavipennis*), and reports that they are destroying Adiantum and other cultivated ferns in a green-house. They will also attack Begonia plants. These beetles acquire their popular name from their leaping powers, a habit which greatly adds to the difficulty of capturing and destroying them. I have found the best means of circumventing their activity to be to lift each pot gently and stand it in a large tray or bath containing water with a film of kerosene. Then shake and disturb the leaves of the plant, when the beetle will hop out and fall into the water. This should be done day after day until all the beetles have been captured. The larvae of the beetles are probably feeding upon the roots of the plants and will be hatching out from time to time. But if this treatment is repeated whenever the beetles appear, they will be unable to lay any eggs and the brood will be exterminated. Some weak Phenyle—or Jeye's Fluid—and water, poured on to the earth round the roots will kill the larvae; but this must be done carefully or the plant will be injured. A more radical cure, if the building can be rendered practically airtight, is to fumigate it with hydocyanic acid gas; but this is a dangerous operation and can be recommended only when expert supervision is available.

Correspondence.

SARSAPARILLA.

DEAR SIR,—With reference to Mr. Geo. Weerakoon's letter in the July number of the "Tropical Agriculturist and Magazine of the Ceylon Agricultural Society," I might mention that the author of "Palms and Pearls of Ceylon' has unfortunately perpetrated a number of errors regarding our Ceylon Flora in his otherwise very entertaining and instructive book.

As pointed out in my letter which appeared in the April number of the Magazine, true sarsaparilla is neither found wild nor cultivated in Ceylon. Mr. Walters, like many others, is confusing the officinal Sarsaparilla (*Smilax officinalis*) with Indian Sarsaparilla (Sinhalese *Iramusu*) *Hemidesmus Indicus*. The only local congeners of the true Sarsaparilla (Smilax) genus are the plants known to the Sinhalese by the name of *Kabaressa*. also used medicinally.

Bonkohomba referred to by Mr. Geo. Weerakoon is *Munronia pumila*, a well-known Sinhalese drug which has the same properties as the officinal Chiretta (*Ophelia Chirata*).

Yours faithfully,

C. DRIEBERG.

Government Stock Garden, Colombo, 31st July, 1906.

THE SWAMP GUM.

SIR,—Will you kindly inform me what is the scientific name of the "Swamp Gum"; and if it does, as its name seems to imply, grow in swampy land. Also, if there are any other trees, useful for fuel, which will grow in swamps at an elevation of 3,500 feet.

Yours faithfully,

S.

Peermaad, 29th July.

[*Eucalyptus viminalis*, *Gunnii*, and *pauciflora* are all known as Swamp Gum in Australia. These and other species of *Eucalyptus* would probably grow in swamps at the elevation mentioned.—ED.]

Current Literature.

"*Le Cocotier*.—Culture, Industrie et Commerce dans les principaux pays de production,' by E. Prudhomme, Director of Agriculture, Madagascar. Published by Augustin Challamel, Paris; pp. 491, with photos and diagrams. In this fairly exhaustive work on the coconut palm (*Cocos nucifera*), its cultivation and products, Mons. Prudhomme has given an account of the coconut planting industry in all the countries where it is carried on, with special attention to his own colony of Madagascar, Ceylon, Cochin, Malaya, and the Netherland Indies. In the early chapters he deals with the varieties of coconut in different countries, and very useful are the plates, showing 20 varieties of nuts in section, and the drawings of sections of other nuts. These show at a glance the relative shapes and sizes of different varieties and the proportion in each of husk and kernel. The propagation of the plant is fully dealt with, and here also the aid of photography is sought to show the results of seed planting in different ways. Excellent results have been obtained in Madagascar on private plantations by placing the seed nuts vertically in the soil with the point downwards, but official ex riments in Madagascar show that the best ways are (1) placing the nut obliqu y with the point downwards, (2) placing the nut horizontally. The manuring of the plantation occupies considerable space in the book, and the work and experiments of Lepine, Bachoffen, Müntz and Gerard, and Cochrane are referred to; while for the genera cultivation of the estate the methods of several well-known Ceylon plantations are given as good examples. Pests and diseases occupy one chapter; the Black Beetle (*Oryctes Rhinoceros*) and the Red Beetle (*Rhynchophorus ferrugineus*) being the chief mentioned. Part II. deals with coconut products; copra, oil, poonac, desiccated coconut, fibre, juggery and arrack, and coconut butter. Part III. deals individually with the various coconut growing countries, and the trade in the different coconut products. Mons. Prudhomme has already made a name for himself in connection with tropical agriculture, and this work on the coconut will enhance his reputation—I. E.

Relating to the Sugar Industry in Peru.—By T. F. Sedgwick: published by Haya, Verjel and Cia, Trujillo, Peru. Although not a great planting country Peru seems to have done fairly well with sugar. In the planting districts the soils as a whole are deep and their physical composition renders them very retentive of moisture, while the drainage in the valleys is excellent. The soils are of the alkali type. Sugar was first planted in Peru in 1570, but the modern industry dates back only 30 or 40 years. The early modern factories were elaborately put up and equipped; "sugar was at a good price, money was easily made and liberally spent in appliances then in vogue. Some factories had all the appliances that could be, made of copper. This desire to have the best regardless of expense extended to all departments of the estate. Sugar then took a turn and went down, and many of the estates had to go out of business." The tendency now is to group the estates by purchasing or leasing, working with a central factory; so that the larger places control upwards of 15,000 acres each. As regards labour, the labourers are well treated in every way, and the usual shortage of sugar growing countries is not felt; in this respect Peru may have accomplished what many other countries have failed in. Good modern machinery is used for cultivating, and irrigation is extensively practised. Methods of manufacture vary considerably, but in most factories the work is excellent and up-to-date. Manures, fertilizers, and the methods of reclaiming alkali soils are treated, and the work gives a good insight into the sugar industry of Peru.—I. E.

The Ceylon Board of Agriculture.

The Twenty-first meeting of the Board of Agriculture was held in the Council Chamber on Monday, the 2nd July, at 12 noon.

His Excellency the Governor presided.

There were present the Hon'ble Messrs. H. L. Crawford, C.M.G., S. C. Obeyesekere, P. Arunachalam and F. Beven, Messrs. L. W. Booth, R. B. Strickland, M. Kelway Bamber, Daniel Joseph, G. W. Sturgess, R. Morison, Dr. J. C. Willis, the Maha Mudaliyar, and the Secretary.

Mr. M. Suppramaniam was present as a visitor.

BUSINESS DONE.

1. Minutes of last meeting were read and confirmed.
2. List of new members was read, and they were declared duly elected.

3. Progress Report No. XX. was circulated. In connection with the Report His Excellency the Governor referred briefly to the subject of rotation of crops on chena lands.

4. A paper was read by Dr. Willis on "The Improvement of local Races of Plants." At the desire of H. E. the Governor, Dr. Willis promised to have the paper printed in the form of a leaflet.

5. The recommendation of the Finance Committee—"That the Agricultural Instructors should be paid subsistence allowance at Rs. 4 per diem when travelling on duty, and the second clerk Rs. 2 per diem unless when travelling in out-of-the-way districts and using a cart, when he should be paid Rs. 4" was approved.

6. The Secretary submitted a *precis* of suggestions received from Local Societies with regard to the proposed Ordinance for the Destruction of Agricultural Pests and the Sanitation of Plants. The following members of the Board were nominated by H. E. the Governor as a Sub-Committee to consider the suggestions made and draft a final recommendation to Government:—The Hon'ble Mr. S. C. Obeyesekere, Hon. Mr. Beven, Dr. Willis, and Mr. Bamber.

7. A report was submitted from the Sub-Committee appointed to consider the offer of Mr. M. Simon Fernando Sri Chandrasekara, Mudaliyar of Moratuwa, to hand over to the Society two blocks of land at Horetuduwa, and a site for an Industrial School, together with a sum of Rs. 2,500 towards the cost of initial operations and maintenance.

The Sub-Committee recommended that the offer be accepted as regardsl the land offered for a flower and stock garden and the cost of opening them, but that the offer of an industrial school was a matter for the consideration of the Director of Public Instruction rather than of this Society.

The following resolution was proposed by the Hon. Mr. Crawford, seconded by the Hon. Mr. Obeyesekere, and unanimously carried :—

"That the Society accept the most generous offer of Mudaliyar Simon Fernando Sri Chandrasekara to convey to the Society two blocks of land for experimental purposes, and to expend Rs. 2,500 in the preparation of the lots for the cultivation of fruit, vegetables, and flowers ; and that the thanks of the Society be conveyed to the Mudaliyar."

Agricultural Society Progress Report. XXI.

The membership of the Ceylon Agricultural Society is now 1,110. The Madura Agricultural and Industrial Association has been affiliated to the Ceylon Agricultural Society as a life member.

The following are the dates fixed for Agri-Horticultural Shows :—

Kurunegala	August 23, 24, and 25
Avisawella	September 7 and 8
Kegalla	September 21 and 22
Telijjawila (Vegetable and Fruit Show) ...	September (about end)
Wellaboda Pattu (Galle)	November 16 and 17
Three Korales and Lower Bulatgama (Market Show)	October 21
Batticaloa	Early in 1907
Telijjawila	March 15, 1907

1. *Harispattu Local Branch.*—At a meeting held at Katugastota on 30th June last under the presidency of Mr. P. B. Nugawela, Ratemahatmaya, it was decided to form a Local Branch for Harispattu. Over 300 were present at the meeting, and 190 joined as members. Mr. Nugawela, Ratemahatmaya, offered a prize of Rs. 10 for the best school vegetable garden in the district. Mr. N. Wickremeratne, Agricultural Instructor, was present and addressed the meeting. Voluntary donations of Rs. 243 were subscribed by supporters of the movement. It was agreed to apply for land to open an Experimental Garden and Cattle Farm.

2. *Mullaittivu Local Branch.*—At a meeting of the Local Branch at Mullaittivu held on the 24th July it was decided to enrol experimenting members, waiving the subscription in the case of villagers who cannot afford to pay, on their undertaking to carefully carry out experiments and report results to the Society. Such members will be selected from lists of those recommended by the headmen.

3. *Telijjawila Local Branch.*—A Show of Agricultural and Industrial Products of the Weligam korale will be held on the 15th March, 1907, at Weligama; and an Interim Fair has been arranged to be held at Telijjawila towards the end of September, with the object of its serving as a rehearsal of the bigger Show in March. The exhibits at the Interim Fair will consist of grains, vegetables, and fruit.

4. *Market Show at Yatiyantota.*—The Market Show has been postponed for 21st October on account of the fever epidemic prevailing in the district.

5. *Dumbara Local Branch.*—The members of this Branch have started a Co-operative Credit Society for the purpose of supplying seed grain to villagers at a low rate of interest. Over Rs. 1,000 has been subscribed by 66 shareholders. Rules have been framed on the basis of those adopted in Bengal for the conduct of such Societies, and four centres have been selected for the erection of seed paddy stores. The progress of this movement will be watched with interest, and it is hoped that its success may be such as to lead to the formation of similar Societies in other parts of the Island.

6. *Wellaboda Pattu (Galle) Branch.*—A progress report on the Experimental Garden in Wellaboda pattu (Galle) was submitted at the meeting of the Local Branch held on the 10th July. It was agreed at the meeting to offer an additional prize for the best plot of vegetables grown in the pattu at the Show to be held in November next.

7. *Experimental Garden, Ruanwella.*—The Experimental Garden at Ruanwella has been fenced off, and preparations are being made for planting it with cotton seed, vegetables, pineapples, mangosteens, and fruit trees.

8. *Experimental Garden, Kegalla.*—A site at Pitihune, within the town of Kegalla, has been selected for the Experimental Garden.

9. *Experimental Garden at Katana.*—A start has been made by the Local Society in planting the Experimental Garden. Thirteen members agreed at the meeting held on the 6th July to contribute towards the cost of engaging a man with experience on Rs. 10 per month. Three other members undertook to plant portions of the garden at their own expense.

10. *Soy Beans.*—The Honorary Secretary, Telijjawila Local Agricultural Society, reports:—"I have the honour to report with regret that not one of the soy bean seeds germinated. The seeds were more or less rotten."

11. *Seed Supply.*—In May last 36 varieties of vegetable seeds were imported from Germany, Sarampur Gardens, Calcutta, Madras, and Bangalore Botanic Gardens. Ninety-five applicants were supplied with 1,885 packets of seeds; seeds for Provincial Road Committees and Irrigation Stations were supplied at half price. Twenty-five applicants did not get seeds, the supply being insufficient to meet the demand.

12. *Kiushu Paddy.*—Mr. Jacob de Mel reports:—"The report from my conductor states that after the 20th May the flood water from Ja-ela canal, coming into the fields at Muturajawela at an unseasonable time, killed the paddy bushes, which were not more than 12 inches in height."

The Honorary Secretary, Telijjawila Local Society, writes under date the 16th July:—"I have to report that the paddy did not grow. It germinated at about the same time as other varieties sown for yala. It was sown in a part of a field near the Telijjawila Experimental Garden, and grew to a height of about 8 inches and then withered away. Every care was taken in its cultivation under my personal supervision; and, all the conditions having been favourable, its failure can only be attributed to its being unsuitable to this country."

Mr. W. R. Bibile of Badulla reports:—"The half bushel of Kiushu paddy was sown on a piece of unfertile field. The soil of the land is sandy. The paddy was sown on the 24th April last, and a portion was transplanted on the 19th May last. The plants began to blossom on the 4th June last and were reaped on the 17th July. The yield was only 3 bushels of paddy. This poor crop is owing to the unfertility of the soil and the scarcity of water. The plants did not grow more than 2 feet in height. In my opinion this paddy is not suitable for transplanting, as the plants do not grow to a sufficient height to transplant within fifteen days. This paddy ought to succeed on fertile fields, and must be sown before April."

The Secretary, Badulla Branch, reports:—"I have just visited a field where a bushel of Kiushu paddy was sown. In the same field on the same day as the Kiushu paddy was sown native paddy was also sown in parallel ridges. The field is a good one, and there was no lack of water. The Kiushu crop can be harvested about six weeks earlier than the native crop. But, on the other hand, there will not be half as much straw from the former. Neither will there be half as much grain. The ears of the Kiushu plants are very short, and worse still the grain promises to be very small. If similar experiments produced similar results elsewhere, I beg to think that the cultivation of Kiushu paddy is not very profitable, except where water cannot be procured for about four months at a time.

The Society will be glad to receive reports of results of their experiments from other members who tried this paddy.

13. *Honduras Paddy.*—Mr. W. R. Bibile, in the course of a report to the Superintendent of School Gardens, writes:—"The handful of Honduras paddy which you sent me was sown on the 17th January last, and the yield was seven measures. This was sown on a piece of very fertile land. The crop was damaged by flies, and if not for this the yield would have been more. This paddy takes two and a half months to blossom and four and a half months to reap."

14. *Seed paddy from India.*—A consignment of about 475 bushels of *six-months* seed paddy has been received from India. The paddy is being distributed among the applicants from the Royal Botanic Gardens, Peradeniya. A small consignment of *Banku* paddy, which takes four and a half months to harvest, is expected in a day or two. The quantity available at present is only 22½ bushels.

15. *Fruit Trees.*—The Telijjawila Local Society has been sent a supply of fruit trees free of charge from the Royal Botanic Gardens, Peradeniya, viz., 2 loquats, 2 rata-karapinchas, 3 coco plum, 3 star apple, 4 Avocado pear, and 8 China guava.

16. *Manures.*—Manure for experiments in fertilization has been supplied by Messrs. Freudenberg & Co. to—

Mr. H. Amarasuriya for coconuts.
Mudaliyar, Wellaboda Pattu (Galle), for orange trees and vegetables at Weregoda Experimental Garden.
Anuradhapura Local Society for tobacco.
Mr. P. B. Nugawela, Ratemahatmaya, for vegetables.

17. *Local Soap.*—Samples of soap, manufactured by Mr. D. Chandrawarnam of Kotahena and exhibited at the Colombo Agri-Horticultural Show, have been forwarded to the Imperial Institute to ascertain their value in England. The Government Chemist has also been asked to report on the soap.

18. *Castration.*—The following demonstrations have been given during the month:—

North-Central Province: Alukaranda, Imbulgaswewa, Hiripitiyagama, Nelbegama.
Central Province: Ragalla.
North-Western Province: Padeniya.
Province of Sabaragamuwa: Kegalla, Mawanella, Pinnawala, Ambepussa.

Up to date 2,002 cattle have been operated upon this year, brought by 1,604 owners at 90 demonstrations. 113 men have been taught the operation. Three men each at Mawanella, Kegalla, and Pinnawala have been trained in the new method of castration of cattle, and fifty animals were castrated in these districts by these men.

19. *Prickly Pear.*—The Jaffna Branch proposes to try an experiment in exterminating prickly pear, which has grown very thick on the Delft Island. The method to be adopted consists in spraying the plants with a solution of sodium arsenic, which has been used with good results in West Australia.

20. *Caterpillar Pest in Paddy.*—A caterpillar pest in paddy fields was reported by the Assistant Superintendent of School Gardens from Karandawala in Maturata district. The Government Entomologist reported on the specimen sent him as follows:—

"The insects concerned are the larvæ of a minute pyralid moth belonging to the genus *Nymphula* (family Pyralidæ). These larvæ are aquatic, and are provided with a series of filamentous gills on each side of the body enabling them to breathe water instead of air. They are consequently not amenable to treatment by flooding. On the other hand, if the water could be entirely withdrawn from the affected fields for twenty-four hours or more without serious injury to the plants, it is probable that exposure to the heat of the sun would destroy the delicate caterpillars. An experiment should first be tried on one or two small sections of the field. If that prove successful, the remaining area should be similarly treated—the whole field at one time. If treated in sections, the larvæ will merely migrate to adjoining sections."

The pest has now disappeared, but the Ratemahatmaya of the district has been instructed to make the experiment suggested should the caterpillars reappear.

21. *Publications.*—The Editor, "Sihala Samaya," sent 50 copies of his paper containing translations of minutes of the proceedings of the Board of Agriculture held on the 2nd July, 1906, for distribution to Local Societies.

The Editor, "Dinakaraprakasa," sent 50 copies of his paper with similar contents, which were distributed among the Local Societies.

22. *Leaflets* on "Tobacco Cultivation in Dumbara," in English and Sinhalese, have been distributed; Tamil copies will be ready shortly. Leaflets on the "Bud Rot of the Coconut Palm" by Mr. Petch, and the "Improvement of Local Races of Plants" by the Director, Royal Botanic Gardens, are with the Government Printer—with translations in the vernaculars.

A. N. GALBRAITH,

Secretary, Ceylon Agricultural Society.

August 6, 1906.