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The Price of Rubber.

The general impression held in Ceylon, in spite of all efforts to remove it, has been that Ceylon rubber has been getting the highest price on the market, because, forsooth, a pound sells (at present) for 5s. 7d. against 5s. 1d. for a pound of fine Para.

Those who make this statement forget the amount of water present in the Amazon rubber and not present in the Ceylon. The former contains about 18 per cent, the latter less than one. If now we do a very simple sum in proportion, the value of the *rubber* in the samples from Ceylon and from Para is as $\frac{6}{9}\frac{7}{9}$ to $\frac{6}{8}\frac{1}{2}$, or as 5494 to 6639. In other words, the value of Ceylon rubber is roughly only five-sixths of that of the Amazon rubber, or 16 per cent *less*.

No one who examined the samples of Amazon rubber at the Ceylon Rubber Exhibition could fail to note two points: (1) that it was far 'springier' than the plantation rubber (whether from Ceylon, the Straits, or Mexico), and (2) that it was so wet as to be white and opaque or very little translucent, and smelt of creosote.

As has already been said, now is the time to try experiments on curing of rubber, and two directions are at once suggested by a consideration of the above. If we make biscuits with creosote, and press them while still wet into a block, we shall save vastly in expense of preparation, and if while dry rubber is selling at 5s. 6d., we can get even 4s. 10d. for this, we shall really be getting a better price. Smoking is also suggested, for it is possible that the quality of the Amazon rubber is in some way dependent on the fact that it has been treated with smoke.

The Peradeniya department has already arranged to make wet biscuit block and have it sold in London for comparison, but as it is quite probable that buyers will look askance at the first consignment of this novel form of rubber, it is desirable that others should follow it.

GUMS, RESINS, SAPS AND EXUDATIONS.

Rubber Shipment to London.

By C. Devitt.

A Lecture delivered at the Ceylon Rubber Exhibition, Royal Botanic Gardens, Peradeniya, on September 22nd.

One of the most important points in the packing of plantation rubber is, as you all know, to get it absolutely dry and quite free from surface moisture before shipping, as any dampness, even if it is only on a few biscuits or sheets, is likely to ruin the whole case-full. We very often find where moisture has been left, the rubber has turned white and decomposition has started, making it unsightly, weak and evil-smelling. Another point of importance is not to put biscuits showing the slightest trace of tackiness into the same case with fine; it is better to throw them away. We also very often find good scrap spoilt by tacky pieces, and rejected from the fine being put in with it. Buyers do not like qualities mixed at all, and frequently parcels are spoilt by the presence of a few pieces of inferior quality. Even if there is only one piece, it has to be shown in the sample. Crêpe is the worst offender. Samples of a shipment come up from the wharf, fine pale stuff with one or two inferior dark pieces. When the buyers see these they mark it down in their catalogues as fine pale crêpe mixed with inferior dark and value accordingly, not knowing what proportion it is in, and to obtain which involves great expense and trouble. Some planters grade their rubber and mark it accordingly, such as No. 1, 2, and 3. There may be the slightest difference in the quality and appearance of say No. 1 and No. 2 crêpe, but a buyer having an order for No. 1 at 5/7 would perhaps be willing to pay just a shade under for No. 2; but seeing it marked at No. 2 he would be afraid to buy it as No. 1.

THE SIZE OF THE CASE

is quite unimportant now that the draft is uniform. 1½ cwt. seems to be a popular weight, but it really does not matter so long as you do not make them too heavy, as it causes extra labour in handling them. To have good strong cases is essential, the rubber is liable to contract in transit between the estate and London and becomes a loose mass, bumping badly about inside, and an extra rough piece of handling will knock the sides out.

Paper must on no account be used in between the pieces. It does not matter whether it is biscuits, sheet or crêpe; in nine cases out of ten it will stick and cause great expense to have it removed.

THE FORM OF RUBBER PREFERRED.

It is impossible to say in what form the rubber is to be sent in the future, but at present the block seems to be most popular among everybody. 2*d.* per lb. is a big premium. We very seldom see a difference of more than ½*d.* per lb. between fine and extra fine. As a rule when the price is made, the rest go at the same, unless there is anything wrong with a lot, and then a ½*d.* or 1*d.* is knocked off; or there may be a small order for very fine, and then you may get a ½*d.* more.

There is no objection to biscuits or sheet in London; but it is for planters to decide whether they can make them and dry them in their thousands. There still seems to be a slight prejudice against crêpe, as it is ½*d.* per lb. below other forms; but if it is the most convenient form for planters, manufacturers will have to get

overtheir objection if they want the rubber. The same with scrap. The old hand-made form is still the most popular, for the reason that buyers can see exactly what is in it, while the majority of crêpe scrap is dark and appears to have foreign matter in it. But I understand that the former is far more trouble and takes a great deal longer to prepare than the latter. Therefore it will have to come as crêpe, and buyers will get to know certain marks and will be sure of what they are getting and always stick to them.

At present crêpe is valued almost entirely on colour, and I heard of a case from a planter where he sent home some scrap crêpe of very good colour, and realised within a shade of fine; but he thought he would improve on it by making it thicker which, of course, made it appear darker; for this he only got the price of scrap.

NEW FORMS OF RUBBER.

It is very hard to find out if a new form is liked on the market. A planter may invent some new method and ship a parcel over. Buyers eye it suspiciously and will not give its real value, the planter hears the result of the sale and stops making any more and goes back to the old. Things must find their level soon, and we hope before long to get manufacturers to say definitely what they like best. All they say at present is that they want evenness in every way; that is to say, good, strong, pure rubber of good appearance and colour. It doesn't matter whether pale or amber so long as it is bright looking and transparent. This is of course rather difficult to get owing to the strength varying so, probably due to difference in the age of the trees; when the quantity of Plantation Rubber has increased considerably, buyers will be able to pick and choose the stronger and better lots, and I have no doubt that there will be a considerable difference in price between the two qualities. The reason why all the fine fetch within a fraction of each other is because the buyers have to take good and indifferent alike—the quantity offered at one time not giving them the chance to pick out the stronger and better lots.

SEPARATING RUBBER FROM OLD AND YOUNG TREES.

Planters ask if it would pay them to keep the rubber from old trees separate from the young; for undoubtedly the strength of the rubber is in a great measure due to the age of the trees from which it is obtained; and I think most of us are agreed that this is so, after seeing the samples from old trees at the Exhibition. I do not think it would pay to keep the two separate at present; but I have no doubt that in the near future, when quantities increase, it will.

With regard to the tapping of young trees, it may not do the trees themselves any harm, but it is likely to lower the high standard at which you are all aiming. I have every hope and have no doubt that plantation rubber will be the standard of the world, not only in purity but in strength, and all the properties for which the Amazon rubber is noted. But I should not decide for certain that when your trees are old all their rubber will be stronger, for I have seen some biscuits from 21-year old trees as weak as anything. (Applause.)

THE DISCUSSION.

Dr. Willis said he thought that they had just listened to a most interesting lecture from Mr. Devitt. He was sure the subject of packing rubber for London was of very great importance to all planters. He would like to call special attention to what the lecturer had said about the mixing of rubber. He said that at present the amount of rubber that went to London was so small, that it did not very much matter. He had occasionally seen people mixing biscuits from very young trees with biscuits from very old trees. He had found two biscuits in the same lot, one of which was good and strong, and the other which was much weaker and could be pulled in half with some effort. As soon as the market got large quantities of

their rubber, it would be sold not on the fact that it was Ceylon rubber, as at present when people wanted to buy it chiefly for experiments, but on the strength and physical qualities of the rubber; and the sooner they learned to keep their rubber of a fine grade separate and not mix it, the better. As regards that, he said a good many people graded their rubber at present, but he thought the most of that grading at present was done according to colour and other fairly obvious properties, because the few analyses which had yet been made to test the strength &c. had shown a most extraordinary difference in the various kinds of Ceylon rubber. There were some published in the *Tropical Agriculturist* the other day, giving the tests made in America, and it was shown that they came out in a tensile strength from 85 to 145. That was a considerable difference, but they did not know what it was due to. Rubber from older trees, it is obvious, is the stronger rubber, and he gathered from all the remarks made by these gentlemen from London that it was strength that was the main quality; and he therefore personally thought they would have to come to some machine like that exhibited by Mr. Carruthers for the purpose of testing the quality of the rubber for strength. The London people at present went a good deal by colour, because they were a little afraid that the rubber, some of it being very dark, might not be pure, but he thought that after some time, as in the case of tea and cocoa, they would get to know that the Ceylon planter does not adulterate his products, and that it is unnecessary to look for impurities in his rubber. As he had said the other day, now was the time to experiment with the making up of rubber for shipment and the shipping of it in different ways before the market had got wedded to one particular way. He hoped there were many proprietary planters, who were comparatively independent, who would take the opportunity of experimenting in shipment. They might lose a penny or two at first, but important knowledge would be gained. He had seen people mixing tacky rubber, too, along with good rubber. A planter had said the other day that if they put a piece of tacky rubber in the middle of a block and squeezed it, nobody would recognise it. But Mr. Bamber had told them a certain type of tackiness was infectious and it might spoil the whole block. It was important not to mix tacky rubber with good rubber. It should be kept separate. It might be possible to pass it off at first, but before long the buyers would be sure to find out, and the price of the whole lot would go down. With regard to shipment, Mr. Devitt inclined in favour of block, and most of them who had seen the Lanadron blocks in the Show were inclined to agree with him. These blocks contained 25 lb. of rubber, and it was obvious they occupied a much less space, and, consequently, cost much less in shipment, and they exposed less surface to the air than did a similar weight of biscuits, and therefore less oxidation went on. They were beginning to know that oxidation of the surface had a considerably deteriorating effect.

HOW RUBBER ARRIVES IN LONDON.

Mr. James Ryan:—I should like to ask Mr. Devit how rubber arrives in London at the present moment—the form of package which he recommends most, and the condition of scrap, biscuits and crêpe on arrival. I want to know, for example, whether these biscuits on the voyage by contraction or agglutination stick together, and what process is used for removing them when they do arrive; and what package does he consider sufficiently strong for a cwt. or a half cwt.? He warned us against using weak packing. I wish to know what package he recommends.

Mr. Devitt:—These biscuits arrive in an agglutinised mass. I do not think you will find any way in which the biscuits will not be stuck to a certain extent, but they can always be pulled apart unless there is some tackiness. As regards the case, I think most planters agree with Mr. Campbell, who said the other day that

rubber was worth a good coffin, and that was why he did not like packing it with a piece of sacking round it. I should like to see some shipped in the way suggested by Mr. Ryan. It would, however, have to be opened and repacked in London.

Mr. RYAN:—That does not answer my question. The question I asked is, how does rubber now get to London?

Mr. DEVITT:—We get it in cases of from 20 to 400 lb. weight. Most of it comes over in ordinary tea chests.

THE QUESTION OF SAMPLING.

Mr. T VILLIERS:—Might I ask, having all these different-sized packages, on what principle you draw your samples?

Mr. DEVITT:—They open them at the wharf and take out a fair average sample.

Mr. VILLIERS:—If there is a 20 lb. case and a 4 cwt. case, what sample would they take from each?

Mr. DEVITT:—Generally about the same. We generally get up 2 or 3 lb. of each, but where it is a large lot of say 20 large cases we get 5 or 6 lb.

Mr. VILLIERS:—Then there is no fixed principle, as in the case of tea?

Mr. DEVITT:—No: it is a fair average sample that is taken. If the rubber is not manifested in different grades, they are assorted according to quality.

Mr. VILLIERS:—On the wharf?

Mr. DEVITT:—Yes; we get up samples of good biscuits and of inferior. They are put in ten cases, say, five cases fine, three cases indifferent, and two of scrap. This is the average sample of the five cases and the other sample is of the three cases indifferent and two of scrap. There is no fixed weight they use. They take a fair average sample at the wharf.

Mr. VILLIERS:—Who is in charge of deciding the amount of the sample?

Mr. DEVITT:—The old experienced men.

Mr. VILLIERS:—From the brokers or from the merchants?

Mr. DEVITT:—They are not brokers. It has nothing to do with us. The people at the wharf are responsible.

Mr. JAMES RYAN:—Well, are you satisfied with the general condition of the packing of rubber in Ceylon, and the way it arrives in London now? Do Ceylon packages arrive in good condition?

Mr. DEVITT:—Yes, as a whole, but we have known cases where a thin veneer was used and they have come in a broken condition. We have even heard of them being manifested as broken.

Mr. RYAN:—Then we have a disease—what is your remedy?

Mr. DEVIT:—Not to use these thin cases. (Laughter.)

Mr. RYAN:—Oh! That is all very well, but that is like telling a person who is sick not to be sick any more. What kind of medicine would you prescribe? Do you think the ordinary half-inch tea package sufficient, and what form of clamping and nails do you recommend?

Mr. DEVITT recommended the ordinary tea chest with an iron rim round it and one inch to one-and-a-half-inch nails.

Mr. RYAN:—I take it if you used the ordinary tea chests the weight of rubber would be three times that of the tea chest, especially if it was concentrated in the block form. It contracts on the voyage and is constantly edging in and out, and in spite of that you are wholly satisfied with the condition of the arrival of rubber in London.

Mr. DEVITT:—It is not in many cases it is packed in these thin wood boxes, but we have known cases and we do not want planters to go on using them.

Mr. RYAN:—Can you suggest any improvements?

Mr. DEVITT:—I think yours is a very good idea for binding them round with canvas, but I think they would have to be repacked in London at the planters' expense.

Mr. RYAN:—Quite so. I can easily improve on that; but the point is whether your difficulty was that it was difficult to re-open and difficult to repack these packages because that can be got over by a different method of tying and pleating. Do you recommend the addition of some disinfectant to the outer surface, such as formalin? Would that be an objection to the trade?

Mr. DEVITT:—I think it would.

Mr. RYAN:—Would they be able to detect formalin, if applied externally to the package?

Mr. DEVITT:—I think so.

Mr. RYAN:—Then you have spoken of paper and warned us against its use. You spoke of plain paper? Have you had any experience of waxed paper?

Mr. DEVITT:—I only saw it in the Exhibition, and it seemed very satisfactory.

Mr. RYAN:—How about the ventilation of the case?

Mr. DEVITT:—It will get quite enough, I think. There is no need to make special ventilation.

PACKING IN SACKING.

Mr. RYAN:—Mr Brett complained that any form of pressure applied to the rubber in the form of sacking seemed to have a deteriorating effect on the rubber.

Mr. DEVITT:—We get rubber from other parts of the world in bales, and when it is being cut it has to be cut right through the sacking, which has become attached to it; and the sample is sent up in that way.

Mr. RYAN:—It seems to me it is perfectly evident you must have some simple substance to put in between the packing and the rubber. How would thin strips of veneer do?

Mr. DEVITT:—I think that would get over the difficulty.

Mr. RYAN:—My object is to try and elicit from you some idea as to what you would suggest would be the very best method of packing. We are not going to spoil the ship for a ha'penny worth of tar, but at the same time we have a natural desire to economise. Proceeding he said, they would like to get information on this point by experiments. He would like Mr. Devitt to take home some rubber packed in various ways and report to him, and those individuals that would be associated with him, on the way it arrived in London. He would like to send it home by a way that it would reach home after Mr. Devitt had arrived himself, if necessary sending it round Cape Horn. He would like to have it knocked about a good deal, so that when they got Mr. Devitt's report they might know whether they were not groping in darkness or walking in the light. (Laughter, and Hear, hear.)

Mr. DEVITT:—I cannot tell you how your packing will answer until I see it arrive in London. The blocks we received so far were in beautiful condition. These were packed in a strong case. They were stuck together, but there was no actual tackiness. We took them from each other with a crowbar; they were quite satisfactory. The case was of half-inch wood.

Dr. WILLIS said that with regard to the packing of block rubber with sacking round it, he saw some planters on the previous day examining the package Mr Ryan had prepared in the show. One planter held it up and let it drop, and

it immediately bounced right out of the window. If they were going to have their packages leaping and bounding all over the docks, there might be some disadvantage. (Laughter.) He did not know in what way it was handled at the docks or anywhere else, but it struck him with this kind of package there might be disadvantages.

THE DOCK LABOURER AND RUBBER.

Mr. SMITHETT:—What Dr. Willis has just said about rubber bumping is frequently true, and I think planters have to remember that the average dock labourer in London does not care a brass rap what happens to the package he is dealing with. What he chiefly thinks about is of being able to get off to his dinner as soon as possible, or something of that kind. I think that considering the great amount which we hope in the near future you will be able to send to the market, it will not be worth while, as Mr. Ryan has said, spoiling the ship for the sake of a ha'p' worth of tar. I do not know the actual cost of the half-inch tea chest, but considering that you can get half a cwt. of rubber into one, I don't think it will be so great as to detract much from the cost of the rubber. In regard to packing in bales, as Mr. Devitt has said, the fibre inside the packing is very liable to attach itself to the rubber. I have seen several consignments of crêpe sent home in sacks of that, and it was very noticeable that the whole of the outside of the crêpe was covered with small fibre from the inside of the sack. Regarding the Venesta tea chests, I saw some rubber sent home the other day in an ordinary Venesta. I think they are now building a Venesta chest especially for rubber—and they succeeded in getting in a 100 lb. tea chest 248 lb. of sheet rubber. This had contracted and was in a large lump, so that you can imagine how with every movement this 248 lb. of rubber bumped against the sides with the result that we had a large proportion manifested as broken before shipment. I think that the ordinary tea chest is the best Ceylon can do at present.

Mr. DEVITT:—It is very desirable that you should get uniformity as to the size and weight as far as possible. From the Amazon they have the standard size of 32 cases to the five tons. As the quantity exported gets larger it would be advisable to fix upon standards of weight.

THE SEPARATING OF STRONG AND WEAK RUBBER.

Mr. BAMBER:—I should like to call attention to one point. Mr. Devitt referred to keeping the stronger from the weaker rubber when packing, but personally I do not think that is the time when you want to keep them separate. I think myself the latex from young trees, as they come into bearing, ought to be kept separate and coagulated separately and the biscuits made from the different latices kept separate. I have seen cases where a few young trees have been tapped and rendered a considerable amount of rubber from older trees weaker, and it seems a pity to spoil a good thing in that way when you can keep the latices separate.

Mr. RYAN:—I entirely differ from Mr. Bamber. If you have enough to separate, by all means separate; but if you have small supplies, it would pay much better to bulk the latex, and I think you will find that the little good rubber will leaven the lump. I am not talking from the point of theory, but from practice. It is better to have uniform samples from estates than to have little driblets coming in that will vary a few pence per lb. in price. You will find you get more for your rubber, and you will keep your superintendent from the verge of *delirium tremens*. (Laughter.) You must have uniformity, and bulking the latex is the way to secure it. It is interesting for Mr. Bamber to separate latices and measure them by cubic centimetres and find out the specific gravities, but the average superintendent has to take the stuff the coolies bring him, and if he starts sampling and separating and fiddling about, that way madness lies.

Mr. DEVITT :—In regard to the question of sampling, planters rather seem to have an idea that we make something out of the samples, but I may say that every pound of rubber that is taken is accounted for. If the buyer wants the sample he pays for it. If not, it is returned to the bulk before being weighed over.

Mr. ZACHARIAS :—Having brought over some cases from Singapore, we have got some good examples of what rubber looks like when it arrives in London. If you look at our rubber, you will find that the sheets are all glued together ; but there is no tackiness whatever. In fact, the judges were so well pleased with some of them that they awarded them Honourable Mention. They were very thin sheets, and by the time they arrived, although they had filled the packing cases, they had contracted into a small block. There is one point I should like to have an answer to, and that is relating to block rubber. All cultivated rubber in any other form when pulled will never go back to the same place where you started. It always becomes longer by being stretched, whereas I understand fine Para never does that but it comes back almost entirely. I noticed that block rubber stretched in the same way will go back to the same size. I have noticed that in the Lanadron blocks which won the gold medal and also in rambong blocks. I should like to know if my impression is correct, if that would show that the pressing of the crepe adds strength ?

Mr. DEVITT :—I noticed that this morning. I tried some of the strips cut from the blocks and I was impressed at their resiliency. On the other hand, Mr. Wright showed me biscuits from 29½ years-old trees, and they went back to the same size as before after being pulled.

Mr. HERBERT WRIGHT :—They were ⅛ of-an-inch in thickness.

Mr. DEVITT :—Yes, that is so.

RELATIONS BETWEEN THE PHYSICAL PROPERTIES AND CHEMICAL COMPOSITION OF RUBBER.

Mr. HERBERT WRIGHT :—I should like to bring forward one matter to which Mr. Devitt has referred. That is the relationship between the physical properties and chemical composition of the different kinds of rubber. In his recent speech at the British Association Prof. Dunstan said that the physical properties of raw rubber are to be correlated with the chemical composition of the substance itself. To some extent we can say that that logically applies to the different rubbers, it we regard the rubber from different species such as Para, castilloa, landolphia, ceara, &c., and again we can say it holds good if we compare rubbers from castilloa trees of different ages. As has been pointed out, three-year-old castilloa trees possessed 55 per cent. of resin and 8 year-old trees possessed only 7 per cent. That statement of Professor Dunstan is, therefore, apparently applicable to the rubber obtained from castilloa trees of different ages and in a compartive sense to rubber obtained from different species; but when we come to consider our own rubber, Para, it is rather different to see a common agreement. I took the judges over some samples of rubber in the laboratory at the Experiment Station. Some of it was from trees two years old and others from 3, 5, 7, 10, 11 and 29½ years old, and the difference in the physical property was manifest. The ease with which some of the young rubber was torn up was remarkable ; whereas, as has been pointed out, the rubber from the 29½ year-old trees, even our youthful judges were not strong enough to break. We were lucky enough to get a snapshot of them with the ordinary-sized biscuit stretched out to 2 ft. 9 in. between them. The judges have divided the biscuits between them, and are taking them back to England. (Hear, hear.) Therefore we have in Para rubber a definite and conclusive difference in

physical properties, and yet, as we know, the duplicates of the rubbers to which I refer have been shown by Mr. Bamber to have approximately the same chemical composition. The results of Para practically contradict the statements of Professor Dunstan, and I should very much like to know whether it is intended to apply only to rubber of different species, or rubbers from trees of different ages with which we have no acquaintance. It certainly does not apply to our own Para rubber. There was one point I omitted to mention, and that is with reference to the mixing of the latex. Personally, I think it might be as well if we turned out, as Mr. Ryan says, a uniform sample year by year from different estates, because we are now simply starting from the very bottom. The trees can never be younger. The age will increase year by year, and with it the quality of the uniform sample, and this will be appreciated in London.

Mr. BAMBER—replying to Mr. Wright—said: With regard to the comparison of Para rubber from the analysis of strength, the reason they had not been able to do that at present was that they could not have a correct solvent that would extract the solvent matter from the true caoutchouc. They used acids which after some hours would remove the whole of what they called resin, but in the residue that was left there was, no doubt, some other compound which was not true caoutchouc; at least, it had not the elastic properties of caoutchouc. They would imagine that if they took good rubber and bad rubber and extracted the weaker matter, they should find that both samples were the same strength; but he found the residue of strong rubber is much stronger than that of the weaker rubber. In regard to the mixing of latices he could not quite agree with Mr. Ryan. He knew that a very small amount of weak latex would injure or was very liable to injure a large amount of older latex. They had several estates with trees of several years old. As they went on in some years they got in a lot of younger rubber. If that latex was mixed with that of the younger rubber, they spoiled a good sample they had turned out, and, perhaps, that might injure their name. He was only referring to later on when they had their rubber in bearing. He did not think it would be necessary to separate the latices, as he thought after eight years there would be a fair uniformity and strength, although that ought to be a gradual matter as the trees grew older; but he did not think it was worth while taking the precaution while the rubber was in the form of latex to keep the latices separate. It might mean a little trouble to the planters, but it was only a few tappings from the trees as they come in year by year. That would be new rubber, and it would be necessary to keep it separate for, perhaps, two or three months until the trees have got thoroughly into the tapping.

A PHYSICAL TEST.

Mr. WRIGHT:—Following up this point, I should rather like to ask Mr. Bamber whether he thinks that in the case of other rubbers any physical test is likely to be devised which will indicate the chemical composition of the raw material. If Professor Dunstan's statement is correct—that the physical properties can be correlated with the chemical composition, there is some ground for anticipating that it may be possible by a physical test to get some indication as to the quantity of resin or other ingredient in rubber, I should like to ask Mr. Bamber whether it is practicable. Is it scientific?

Mr. BAMBER:—I do not think any physical test would give you the amount of resin. We must find something that will remove the weaker compounds of the rubber. There are other physical tests now employed to determine the resiliency, but it absolutely cannot give you any idea of the chemical properties. For instance, castilloa rubber has a very large percentage of resin. I do not think from the results of the needle test that is usually employed you can draw any deduction as to the amount of resin. It is possible some test may be devised that will give

you the best quality of the rubber, but at the same time I do not think it will ever point out what the chemical properties will be. As far as I can see, Para rubber will never contain more than 3, 5 or 6 per cent of resin at the very most, and I am sure a physical test would show the difference between one and two or even five per cent.

THE IDENTIFICATION OF RUBBER.

Mr. RYAN asked how they were to identify their rubber in Ceylon or when it arrived in London as being the original samples shipped, inasmuch as there was a method which was in daily use in some districts for removing estate marks from biscuits, and which for obvious reasons he would not describe ; but it was a very simple and effective one. If they were to go on producing biscuits, it was evident that they would have to devise a more permanent method of stamping rubber than the present one—impressing a die on it. He thought possibly it might be effected by using a sinking die to raise the rubber, because he thought it would be more difficult to reduce this without leaving an impression than to raise the sunken part to the level of the surface, as was done at present. They might have a press with prickers on it, very much like the method used in Army and Navy Stores and by many firms in London for marking Bank notes passing through their hands. Possibly it might be used in conjunction with some chemical, which by analysis would enable them to immediately detect whether the sample in question had come from the estate. He gave that as a special warning to the Kandy district where the wily Moorman had already devised a method of taking their biscuits and selling them in the open market.

Dr. WILLIS said it might be interesting to several people to know that he had had it illustrated in that Exhibition that the estate marks could be completely removed from biscuits with the greatest ease.

Mr. DEVITT said he had seen several biscuits with the name cut out and one piece cut into square bits to be put in the scrap. In regard to sending large blocks of rubber, he knew a case of one importer of Para from the Amazon who shipped down 100 tons with his mark stamped on the rubber, and when it got to one port it was found that it only weighed 50 tons, although the number of packages was exactly the came. At some place of stopping they must have taken them out and replaced them with others with the same mark on.

Mr. SMITHETT :—Do I understand Mr. Ryan to mean that the brokers are to test every estate mark ?

Mr. RYAN :—Oh, no ; this is directed against thieves in the island. We have people who have a few trees that give a remarkably high yield, and, of course, we know perfectly well where the rubber comes from. The idea is to put a stop to the thieving of rubber, and that again touches another point which will appeal to planters. We have a Praedial Products Act. I can remember that the tea industry was getting pretty old before we could get that Act improved, so as to make it workable in the case of thieving of green tea leaves, or, very often, of made tea. Our friends the cocoa planters have had even more trouble ; and I think it is just as well to start early in rubber, so that we may be ready and protect ourselves in time. We should approach Government and have legislation and protect ourselves in every possible way before our contracts are of a sufficient size to make the losses material ones. I remember in the case of coffee a few estates showed extraordinary prosperity and plumpness in the neighbourhood, and when the coffee crash came, it gave the quietus to the natives on the neighbouring coffee estates ; they could not steal the European coffee. They were reduced to a state of penury by not being able to steal our coffee which was pitiable to witness. (Laughter.)

A vote of thanks having been passed to Mr. Devitt for his paper, the meeting ended.

Rubber in London.

Two Lectures delivered at the Ceylon Rubber Exhibition, Royal Botanic Gardens, Peradeniya, on September 20th.

RELATIVE QUALITIES OF DIFFERENT GRADES. I.

By Spencer Brett.

London has for many years been a very important centre of distribution for rubber. Its position has lately been improved in this respect, and the headquarters of most of the important buyers and firms handling the product are now centred there. In greater or less volume, it may be said that all grades of wild and cultivated rubber are to be seen on our market, and as the number of the different kinds runs into hundreds, it will be seen that London offers an excellent opportunity for comparing the various grades. The actual commercial value of crude rubber varies from a few pence per pound to nearly 6 shillings, according to the amount of caoutchouc contained in the grade, the nature of the foreign substances, and for other reasons. The exports of Para grades have in the past amounted roughly to one-half of the world's total production, and until the Eastern plantation product came into the field the finer qualities of Para always realised higher prices than anything else. It may be said that Para, *i.e.*, South American rubber, was the foundation on which the industry was built, and the standard methods of compounding and manufacture that have been carried out were based on the character of these grades. The different processes in use have largely been arrived at after many years of experiment,

THE BEHAVIOUR OF DIFFERENT KINDS OF RUBBER

in manufacture being so varied and complicated, that, as new grades have from time to time come on the market, a considerable period has elapsed before manufacturers have worked out the best treatment for them and thus been able to decide their standard value. Under these circumstances it is only natural that, until your Eastern cultivated product has been freely experimented with by the bulk of manufacturers, its intrinsic value is unlikely to be fully understood. In face of this we have the astonishing fact that even from the days when only one or two consignments of a few pounds each in weight came on the market per month, say five years ago, a premium was paid over the prices of the then fine standard American Para grade. Supplies have been short and prices have appreciated very considerably, roughly 50 per cent. in this period, and we still find that the premium for Eastern plantation grades is readily obtained.

The obvious explanation is that the buyer of fine plantation rubber receives from, say, 10 to 40 per cent. more caoutchouc for his money than the buyer of other grades; but unless your cultivated product were well suited to the manufacture of expensive goods, it stands to reason that its use in the factory would not be profitable, and not only is it found worth while to handle the new grade at a much higher initial cost—at a time when prices are cut to the last degree—but actually you have a number of manufacturers who consider it advisable to spend large sums of money experimenting with it, when they can procure at a less cost a rubber for the preparation of which all their mills and machinery have been designed, and furthermore a substance which has from the beginning of the industry supplied all the finest grades of goods for which rubber has been used. Under these circumstances is it to be wondered at, that the manufacturer should hesitate before deciding that he is justified in expending large sums of money in

experimenting with an article, the nature of which is as yet imperfectly understood at a time when, owing to market conditions, he is only just able to get a margin of profit when using a lower priced rubber which he has proved by experience to give very satisfactory results.

I myself know many instances when manufacturers have taken the other course and decided that the present is not the time to start experimenting with the new grade owing to its high cost; but they have quite made up their mind to give it a thorough test when the market favours it. In the meantime those more progressive people who have tried it with good results and are now regular consumers, have all the time been improving their treatment of it, and there are already people who say that not only can Eastern plantation rubber take the place of South American Para, but they themselves are using it in their own factories, for the severest tests to which rubber is subjected.

It is a difficult matter to obtain an inside knowledge of the nature of the rubber manufacturers' business. A great number of them, whose successful career has in some measure been due to the efficiency of their private processes and methods of preparation, are naturally somewhat jealous of these and disinclined to expose them to the critical eye of anyone engaged in the same industry. I very soon realised, however, that much useful information was to be found by getting an insight into this part of the industry; and after some difficulty I succeeded in getting taken over some of the largest mills and factories in England. One of the first things that struck me after this inspection was the very large amount of capital and labour that might be saved in the first stages of manufacture by the use of the fine pure grades of cultivated rubber, but the full benefit of this could not, of course, be felt until large supplies were always available. One of the most important changes that have recently been taking place in the industry is the increase in

THE USE OF SCIENTIFIC METHODS IN THE FACTORY.

From one cause and another it is now generally accepted by manufacturers that a laboratory in their factory with a well-qualified chemist is quite essential. Only a few years ago very few of even the large makers had these; but now you will find that in many cases the laboratory forms a very important part of the factory, and there are many who think that before long analysis may play an important part in the buying and selling of crude rubber. To get an idea of the effect of the rapid rise in prices on the manufacturers of rubber, it is interesting to find that on account of the excessive adulteration that had sometimes to be resorted to, in order to complete contracts extending over long periods without heavy loss, departments which send out tenders for large orders have, on account of the unsatisfactory nature of goods supplied, been compelled to make their conditions far more stringent; and just before leaving London I heard of an important tender having been put out, in the conditions of which the resin contents were not to exceed four per cent, the idea being to necessitate the use of a large proportion of fine Para. In this connection it is interesting to note that the finest Eastern plantation Para would roughly be on about the same footing as fine South American Para on account of its small resin contents. In conclusion, gentlemen, I can only say that we in London mean to continue to do all in our power to promote and extend the uses of your product, and I think I am quoting the general opinion when I say that you are to be most heartily congratulated on the splendid progress that has always been made in the growth, preparation and quality of cultivated rubber in the East, and I am sure that with all the extremely capable and energetic people you have out here, devoting their time and experience to the welfare of the industry, there should be very little doubt that the future is assured for you. (Applause.)

THE PREFERRED FORMS OF PLANTATION RUBBER. II.

By C. K. Smithett.

The relative qualities of the different grades of rubber put on the London market has been dealt with by Mr. Brett very ably; so I should like to say just a few words as to the form of rubber we should like you to send us. So far you have consigned to the home market an article which has gained a reputation for its purity; and the present premium above Para, although it is not now at the very high point obtained early in 1905, is due to the purity of Eastern plantation rubber. So the first point I wish to impress on you is to maintain the reputation you have gained for yourself. In one feature, at any rate, fine hard-cure Para is superior to, in most cases, plantation rubber from Ceylon and the Federated Malay States, and that is in strength. The question I put before you is this. How can you obtain that strength without reducing the present very high standard of purity? It is essentially a question for planters to answer, and the solution can only be obtained by experimenting. The able scientists you have here will, I am sure, do their utmost to help you.

TAPPING IMMATURE TREES.

Do you tap your trees too early? Remember, in the forests of rubber in the Amazona districts trees are very often not tapped until they are over 30 years old, to take a very moderate figure. I believe that some of the rubber in this Exhibition which received the highest awards was from trees 10 to 15 years old; and the other day we were shown rubber from trees from Henaratgoda about 30 years old which showed a very good tensile strength as far as can be ascertained without proper appliances. Plantation rubber is as yet in its infancy, but it is never too early to begin trying to improve. Bad reputations are difficult to be got rid of; so do not let your rubber acquire a reputation of being weaker than fine hard-cure Para.

We in London look forward to the day in the near future, when plantation rubber will be one of the predominant features in the market, but strength is a necessity. I mention this question, as we all in London want Eastern plantation to supplement wild rubbers, at any rate, to a very substantial degree.

I suppose the question which we have been asked most frequently, since we have been in this island, is what form do we want rubber sent to London in. I think we are all agreed on this point.

BLOCK RUBBER.

Let us see some more block rubber. But a word of warning; block rubber is still a new idea, and while the shipments from Lanadron estate have realised 2d. to 2½d. per lb. above fine plantation, it is not an established fact that if all plantation rubber came in block form, that you will all obtain a higher range of prices.

SMOKED PLANTATION RUBBER.

The samples of smoked rubber which we have seen have interested us greatly. We look forward to further experiments in this direction, an essential part in the preparation of fine hard-cure Para, so samples of the rubber cured in a very similar manner would be of great interest.

Buyers are now getting used to fine crêpe, but still some leave it alone; but I think fine crêpe will sell well when all the trade will buy it. I do not think that manufacturers are prepared to accept estate washing as sufficient for manufacturing; so perhaps some planter will answer this question. Does the time saved by making crêpe justify the loss in weight in the washing process? Inferior grades of crêpe were, when we left London, under a cloud and difficult of sale, buyers not being able to estimate the amount of the impurity in it; but from recent reports I gather that the demand is improving somewhat.

BISCUITS AND SHEET.

The former of these I am convinced, will, when the industry developes, have of necessity to be abandoned in consequence of the length of time and amount of labour in preparation, but while you can still send biscuits and sheet you will, I think, find buyers.

In conclusion, the industry regarding actual plantation rubber is young; so until shipments come in more important lines, it would be unwise to definitely decide on any one system of preparation for the London market. We at home in London watch with keen interest the development of this industry, and I can only say we like Eastern plantation rubber and want more, and hope that nothing will happen to make the prospects of good supplies less hopeful than they are now. (Applause.)

THE DISCUSION.

Dr. WILLIS:—Ladies and gentlemen, we have listened to two very interesting papers on rubber, and I feel sure they will provoke a most interesting discussion. I would call on anyone in the room to offer any remarks they may have to offer.

Mr. JAMES RYAN:—I should like to ask Mr. Brett and Mr. Smithett a question *à propos* of the price of rubber in London. I take it that the Ceylon biscuit, which is now getting a price of very close on 6s., is, from information just given me, getting about 6d. a lb. better than fine Para, which Mr. Brett has just told us shows about 20 per cent in the matter of impurities, in some cases 40. 20 per cent of 5s. is 1s., and we are exporting pure rubber and getting a 6d. for our shilling. That appears to be the differential value, and I take it that the rubber imported into London from Para is subjected to the expense of washing which will give the manufacturer a great deal more, and yet he is able to give us 6d. instead of a shilling; so that we may bear in mind that whether it be due to superstition or not, the London manufacturer is not prepared to give us the full benefit of our manufacture in the form of hard cash, and that is the way we want it. (Laughter.)

Mr. SPENCER BRETT:—I assure you the reasons for the difference in price Mr. Ryan has just referred to, are far more tangible than supersition. In the first place it must be borne in mind that I gave the figures of the actual rubber contents—that is, not the actual figures showing loss in washing from the manufacturers' point of view. The manufacturer does not look entirely on pure rubber contents. What he has to do with is loss in washing; because Para, fine hard-cured South American, may only possess 77 per cent of pure rubber, it does not follow that it is going to lose this 23 per cent in manufacture. In fact the rough average of the loss of washing in finehard Para, I think, is 15 to 18 per cent. That is one point of importance. The next is rather more complicated. In the first place, as I have been trying hard to impress upon you, your industry is very young, and I have made particular note that with other grades of rubber it has taken some time—a considerable number of years in some instances—before the methods of preparing these grades have been perfected; and until that has been done, you cannot arrive at a proper standard of the value. In the third place, as you all know, the importations of plantation rubber have been extremely small in comparison with the world's consumption, and to give you an idea I may say that the amount of plantation rubber from Ceylon and Malaya exported into London last year was 171 tons as compared with the total production of 60,000 tons, and that is spread all over the world. I think you will all agree that it gives very small scope for experiment and commercial using; so I think it is only reasonable to expect that some time must elapse and large quantities must be handled by the manufacturers before you can have all the qualities of your produce fully recognised and appreciated. (Applause.)

Mr. JAMES RYAN:—That does not alter the fact. Mr. Brett tells me that 20 per cent is lost in Para rubber by impurities. If I buy one thousand lb. of Para rubber, taking 20 per cent as the net impurities—he says 15 to 20 per cent—he gets 800 lb. of pure rubber and pays 66,000 pence for it; but if he buys 1,000 lb. of Ceylon plantation rubber, 960 lb. is pure rubber; the deduction is under 4 per cent, but he only pays 69,000 pence or an increase of 3,120 for another 160 lb. of rubber—(Laughter).—Which means that he gets 160 lb. of Ceylon rubber at the rate of 2*d.* a lb. (Laughter.)

Mr. SPENCER BRETT:—I would add to my previous remarks by saying there are many other considerations. I pointed out the ones I thought the most important but, of course, one consideration is the point that has been very widely questioned indeed, and upon that no one yet can definitely give a verdict, namely, whether by the nature of the plantation rubber it will be able at any time to supplant and actually take the place of fine hard South American Para rubber. I myself am very hopeful indeed about this, and this Exhibition has greatly increased my hopefulness; but at the same time it is quite impossible at this stage of the industry to get the manufacturers to adopt all those views, and as I have already tried to explain the manufacturers go by results, and until they definitely get these results they will not be prepared to pay a high premium for a grade that they do not fully understand. On the other hand, it is being experimented with all this time, and I think there is not the slightest doubt that once it comes into consumption on a large scale, and is found after severe tests extending over a length of time, I am sure that many manufacturers will handle it instead of fine hard Para. At that time, I am equally convinced, you people will get the full advantage of the superiority of your product. (Applause.)

EXPERIMENTS IN PREPARATION METHODS.

Dr. WILLIS:—Now is the time when we ought to make our experiments in the preparation of rubber for the market. As Messrs. Smithett and Brett have told us, the market is in a fluid condition and we can now try experiments with more chance of success. Supposing we go on making biscuits for another couple of years without trying any other method, biscuits will be on the market in very large quantities, and the market will be so wedded to the biscuit that the manufacturers would begin to look very much askance at any other form of rubber. Now we only make small quantities, but it is time to try experiments of making up rubber in a different kind of way, and we ought to do that. I say this because there are a number of people who say that the time for experimenting is too soon. We know biscuit will work; let us stick to biscuit and let other things be tried later on. The present is the time to try them before the market gets thoroughly wedded to biscuit, sheet or block, whatever it may be. There are so many other forms in which rubber can be placed upon the market, that now is the time to try those forms before the market gets fixed. (Applause.) It seems to me that the subject is of very great importance; and as we have heard a good deal about it from the brokers' point of view, we should like to hear the planting side of it put forward by some gentleman present, who will have a perfect right to do so.

CREPE RUBBER.

Mr. HERBERT WRIGHT:—Mr. Smithett brought forward the question of sending crêpe rubber to the London manufacturers, and he pointed out the disadvantage that a certain amount of material was necessarily lost, but he apparently forgot to remind us that crêpe rubber, as Mr. Smithett convinced me yesterday, is the only form in which rubber can be guaranteed to arrive free from mould or from tackiness. I understood, from conversation with the Judges yesterday, that during the last few months there has been a large increase in the quantity of biscuit, and even sheet rubber, which has arrived in a mouldy or tacky condition, and the appearance of the crêpe during the same period was free from such defects.

Mr. SMITHETT :—Mr. Wright is quite correct in his statement. I think we may say we have never noticed mould appearing upon fine crêpe ; and I think that when the trade becomes used to it, it will sell. But the question I wish to see solved is whether the loss in weight is justified by the time saved.

Mr. WRIGHT :—It is much easier to manufacture rubber in that form, and the treatment that rubber has to pass through is comparable with cocoa in Ceylon. I know in other countries—South and Central America and the West Indies—they do not regularly wash their cocoa before sending it to the market, but they send it in a sun-dried state. Cocoa is sent home from Ceylon as a washed material, because we want to keep up its high standard of purity. If we can associate the higher standard of purity gained by washing with freedom from the defects of mouldiness and tackiness, I think crêpe will ultimately appeal to the Ceylon planters.

Mr. JAMES RYAN :—It takes a very much longer time to make a given finite biscuit than given finite crêpe. The saving in time is practically one of days. This morning a specimen of wet crêpe was made in twenty minutes. I timed the machine very carefully, and from the time the latex was poured into the separator, then into the Michie-Golledge machine to be coagulated under difficulties, and it was passed through the Federated Malay States Engineering Co.'s machine, the time from start to finish was twenty minutes. With a vacuum drying machine the further operation would have taken an hour and a half. The result of the experiments in brick rubber that we have made to-day is equal, if not superior, to that of any rubber in the Show. We took some vacuum-dried crêpe and subjected it to a pressure of 432 tons—three tons to the square inch of 134 square inches—and the result was a block of rubber which, I was informed by Mr. Campbell of Lanadron, he considered superior to that which had taken the gold medal for the best rubber in the Show. The question of time and the question of packing answer themselves, because the question of ocean freight would certainly not exceed half or two-thirds at the outside of the ocean freight of a given sample of biscuit in box, or crêpe in box, or lightly blocked rubber in a box. The question resolves itself into whether the screw pressure which secured block rubber is a method which improved the quality of rubber, which some seem to think it does, or whether it deteriorates quality. Personally I have come to the conclusion that the stored-up energy in blocking rubber promises to improve the individual elasticity and resiliency of rubber—two points I am perfectly certain manufacturers look greatly to. Transparency of appearance is secured by purity. Resilience is a matter which is inherent in the rubber itself. The other point that we have now got to look to is one which can only be determined by a very big series of experiments which have not yet been undertaken. I am sorry that Mr. Carruthers is not here this evening—(A voice : He is here.)—to show us the working of that very ingenious and excellent machine which he has devised, and which unfortunately was damaged in transit, but if he would show us the broad principles we would be glad to wait ten or fifteen minutes longer to listen to it. Rubber is very largely used in electricity. There is the point of electric resistance in rubber, and if we can secure those points of commercial purity and toughness of resilience and the rapid resistance to the strain of buffers, and for springs and coils ; and if we can also get electrical resistance—and we are going to get it—if we could only get it very soon by experiments long before trees are bearing, we shall have solved all these problems, and you will have Ceylon at the top of the tree and Para may whistle down the wind. (Laughter and Applause.)

Mr. CARRUTHERS :—Mr. Ryan in his winning way has forced me to get on my feet, but I do not think I have very much to say, except that I wish very much on behalf of the Farther East to thank these two gentlemen, Mr. Brett and Mr. Smithett, for the frank way in which they have told us their requirements and

given us sound advice as to how we can please our masters, the London manufacturers. As far as I can gather, the matter, put into a nutshell, is that we must go for purity, and that we may expect not only to keep up the present high standard of our rubber and in time to improve upon it after manufacturers have had more experience with our rubber and be able to rival Para. As to the machine Mr. Ryan has kindly referred to, some two years ago I was interested in trying to devise some simple machine which would test the resiliency and elasticity of rubber, and I brought it here because I thought it would interest visitors to the Exhibition. Unfortunately, ever since I have arrived, I have been practically judging from eight o'clock in the morning until dark, and with this were interspersed various hospitable functions and other things which left me no time to put it together. I promise to do so to-morrow, so that any one may see it and judge it for himself.

A hearty vote of thanks to the lecturers was proposed by Dr. J. C. Willis and was heartily accorded.

THE INDUSTRY IN THE MALAY PENINSULA.

The Labour Problem: Lack of Nerve in Rubber.

An interesting interview with Mr. E. Val Carey, a well-known planter of the Federated Malay States, is published in the *Ceylon Observer* (Oct 8th). In reference to the future labour supply Mr. Carey said :—

"The future seems to be perfectly bright. With regard to Indian labour I can see no reason why we should not be able to get all the coolies we want, mainly because the fixity of exchange at 2*s.* 4*d.* has sent up the remitting value of the dollar by 20 per cent; and while the dollar wages remain stationary from the point of view of the local currency equivalent, the actual result of the fixture of exchange is that we get an enormous pull in remitting value. There is no doubt, if there is, as suggested, competition over at the coast between Ceylon and the Straits for labour, the higher rates which—from a remitting point of view—we are paying over in the Straits must attract labour to us rather than Ceylon, especially in the case of new districts in either country which have not previously been established or known to coolies. Apart from Indian labour, anybody who is interested in labour over in the Straits must always remember there is the absolute assurance against a labour famine in the proximity of Java. The Javanese cooly, who is imported direct, enters into indentures to work for three years, and his cost at the end of that period, approximates, and in fact is rather less, than the wages paid to the Tamil."

"Are Javanese plentiful and easily obtainable?"

"The last census of the island of Java was taken in 1902, I think. Java was then shown to possess 32 million inhabitants who are increasing at the rate of 600,000 per annum. The Dutch Government are face to face with this enormous population, and the need for finding supplies for them, which means increasing importation obligations every year—because they are growing so tremendously, and the country is practically cultivated up to the hill-tops—are only too anxious to place these people in localities where they feel they are being well looked after. So that to sum up, the situation, it seems to me as regards Tamil labour, is bright in the extreme. We in the F.M.S., most of us old Ceylon men, have naturally been anxious to employ Tamils rather than Javanese; but supposing for the sake of argument we cannot at any time get sufficient labour from India, we are in the impregnable position of being able to get as many Javanese as we can possibly want."

"It is often said," Mr. Carey added, "China is a further source of supply, but in actual practice the experience is that men have not much use for Chinese coolies in agricultural work, mainly for the reason that they are not able to speak their language, and to successfully work orientals one must be able to get into that intimate touch with them which can only be done by becoming familiar with their language."

Proceeding Mr. Carey then made the following interesting statement:—"One thing which I do think is a very important question," he said, "is this suggested, and I believe real, lack of *nerve* in our rubber in the Straits Settlements and F.M.S. Undoubtedly, without any question, rubber which is extracted from young trees is not so full of tensile strength as that from older trees. The older the tree that supplies the latex, the tougher the rubber; but that does not in my opinion amount to a sufficient reason for the absence of nerve which our rubber undoubtedly shows. I believe myself that the days of sheet and biscuit and crêpe are reaching their end. The reason for that is that we know, in spite of what certain people have said to the contrary, that almost any rubber prepared in a thin form responds to the corrupting influence of the atmosphere and gradually perishes. It is not necessary to expose it to the direct rays of the sun, but if you leave it on your office table you will find as day succeeds day, your rubber becomes less and less resilient; and I put that down to the fact that in our eagerness to secure the most rapid drying, we are placing our goods on the market in the thinnest possible forms, and therefore exposing the maximum surface to what I have called the corrupting influence of the air. At the present moment, I may say, I am having sent home a considerable sample, amounting—I hope—to 2 or 3 cwts. of rubber which has been kindly placed at my disposal by Mr. J. A. MacGregor, the Manager of the Anglo-Malay Rubber Company. This rubber was some years or so ago, when in a freshly coagulated form, made up into rough balls of various sizes—owing, as I understand, to a temporary breakdown in the machinery. A certain amount of moisture was expressed by hand pressure, and the balls of freshly coagulated latex were laid down on the cement floor of the store where they were left until recently, when I saw them there. I had one of these big balls cut open, and I found it honeycombed in the centre with cells containing evidently putrid moisture, and the rubber itself had got on the outside a thin coating, black and shiny, of obviously cured rubber. The inside was perfectly white in colour—as white as the day it was taken out of the coagulating pans—and it had all the appearance of a perfectly immature product in the centre, as indeed did all on the inside of this slight black rim which was just on the surface; but on attempting to break even the smallest portion away from this white mass, I found that the tensile strength was so tremendous, it was impossible to pick out a piece even as big as a pin's head, I was very much impressed with this because, though I have not the exact facts and details as regards the age of the trees from which this rubber was obtained, I gathered from conversation with Mr. MacGregor it was just the average intake of latex from average trees ranging from 5 to 7 or 8 years of age.

"Though, of course, in the absence of scientific examination by means of mechanical apparatus it was not possible to say what the tensile strength of this rubber was, still to the ordinary observer like myself it was perfectly clear it was very much greater than I had ever seen it in any other form. And the conclusion I came to was that the hardened surface had hermetically sealed the contents of the block within to such an extent that even the evaporation of the moisture had not been possible. Nothing could escape and—as nothing could escape—no perishing influence could get in. I believe we shall find very shortly

that if we send home our stuff in blocks which are obtained by hydraulic or any other pressures from a mass of latex, this cry of tackiness and lack of nerve in our rubber will immediately cease.

"I may say that the examination of this piece of rubber took place some weeks before anybody knew Mr. Pears was preparing rubber in block form; and, of course, the rubber I am speaking of has a perfectly different appearance from block rubber prepared by Mr. Pears which, I understand, is quite clear. But it is analogous in every way except for its excessive freedom from impurities, such as pieces of bark, with the Para which the Amazon sends to the market, and which I have seen in large quantities in the rubber factories in America. I propose, directly I get home, to submit this lot to every conceivable test through Messrs. Gow, Wilson and Stanton, who have got a laboratory specially put up to deal with questions of this nature, and as soon as I have completed the report on it I shall communicate it probably to Ceylon as well as to the Straits with Mr. MacGregor's permission."

Mr. Carey's idea is that the latex should be strained and coagulated, smoke perhaps being used as an antiseptic and as much moisture as possible expressed, and then pressed into blocks. He points out that when the demand for plantation rubber for solution is supplied, the market for the Eastern product will depend upon its strength and resiliency; and even although they may have to pay a little extra freight for sending some more moisture home, it is better to do this if extra qualities that will commend it to the buyers, such as strength and resiliency, can be obtained.

RUBBER CULTIVATION IN SAMOA.

The Consular Report on Samoa for 1905 contains the following account of the rubber industry there:—

The Samoa Caoutchouc Company, Berlin, capital £75,000 and upwards, has commenced operations on a large tract of ground at Saluafata, 12 miles from Apia, and has planted out many thousand seeds of *Hevea*. Rubber cultivation being an entirely new thing in Samoa, it is impossible to make a positive and certain forecast regarding it, but in the opinion of some it offers greater advantages than cacao or coco-nut planting. That *Castilloa* will grow here is quite certain; but until tapping has begun and the yield can be approximately ascertained, it is impossible to say whether this or any other rubber tree will yield sap to the same extent as is the case in their natural habitat; but, as conjectured above, this culture appears to be likely to yield, in any case, a profitable return on the capital invested.

Mr. T. Andrew furnishes the following report:—

'In 1904 I supplied your yearly report with a few remarks on the cultivation of *Hevea brasiliensis* in Samoa. Since then the trees have grown rapidly; not so much in height as in girth—they are just six years old from the seed. Measuring twenty-five consecutive trees at 3 feet from the ground, the largest tree measured 24½ inches in circumference; the average of the whole was 17½ inches. Considering the fact that these trees have been entirely under native supervision, with the exception of occasional visits of the owners, it may reasonably be expected that, on plantations laid out by companies and under proper supervision, the trees will present a more promising appearance than do the above under the conditions stated.

'The measurements are by no means insignificant when compared with those made at the experimental gardens of the different districts of the zone of rubber culture. The trees in question are planted 15 by 15 feet among cacao trees, at an altitude of 1,100 feet above the sea. The aspect is favourable, and the distribution of rain is more even than on the low-lying lands which have the same aspect.

Some of the trees are being tapped, and the result of yield and quality of the rubber will be looked forward to with interest by those engaged in the culture, and by others who are waiting for proofs of the results of the experiments. The high prices prevailing for first-class articles, and the apparently permanent demand for rubber, have given a considerable impetus to rubber cultivation in Samoa.

Other companies under able management have commenced operations here. Notably the Berlin Caoutchouc Company at Saluafata, near Falefa, with an area of 6,000 to 7,000 acres. Their first clearing of 500 acres is now ready for planting out and they have about 1,000,000 young *Hevea* plants growing in the nurseries. The situation of this estate is ideal: a gradual ascent from the sea, with a maximum height of, say, 600 feet above it; the rainfall is evenly distributed throughout the year. The soil is splendid, containing sufficient clayey mixture to retain moisture in the event of prolonged dry weather. The whole is almost encircled by a high range of mountains 1,500 to 2,500 feet in height. Next comes Mr. Harman's (Birmingham) Upola rubber plantation. As yet there are no details respecting the operations of this company; but, judging from the rapid progress made by the Upola Cacao Company, which is under the same management, a promising prospect may safely be predicted.'

THE LONDON RUBBER MARKET.

LONDON, September 28th.—At to-day's auction, 334 packages of Ceylon and Straits Settlements plantation grown rubber were under offer, of which about 259 were sold. The total weight amounted to over 20 tons, Ceylon contributing about 2¼ and Straits Settlements nearly 18. The market was fairly steady for all descriptions and good general competition characterised the auction, though in many cases the prices offered for the finest grades (principally crêpe) did not come up to sellers' ideas. A parcel consisting of 20 cases of very fine pressed blocks from the Lanadron Estate (Johore) realised the top price in the auction, viz., 5s. 10d. per lb. The best sheet and biscuits sold at from 5s. 6d. to 5s. 7¼d., and crêpe can also be quoted at the same figure. There was a strong demand for the darkish crêpe running up to about 4s. 10d. to 4s. 11d. In Ceylons, one or two cases of fine biscuits realised 5s. 7d. per lb. Plantation fine to-day.—5s. 6d. to 5s. 7¼d., same period last year, 6s. 2d. to 6s. 3d. Plantation scrap.—3s. to 4s. 6d., same period last year, 3s. 10d. to 5s. 4d. Fine hard Para (South American).—5s. 1½d., same period last year, 5s. 6d. Average price of Ceylon and Straits Settlements plantation rubber.—259 packages at 5s. 5¼d. per lb., against 163 packages at 4s. 9d. per lb. at last auction. Particulars and prices as follows:—

CEYLON.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
F. B.	1 case scrap and rejections, 4s.; 1 case dark scrap 4s.; 2 cases ditto, 4s. 1½d.
Warriagalla	1 do good pale amber to darkish biscuits, 5s. 6d.; 1 bag ditto dark, 5s. 4d.
Ballacadua	3 do fine pale and palish biscuits, 5s. 7d.
Waharaka	1 do good darkish biscuits, 5s. 7d.; 2 cases darkish scrap, 3s. 9d.
Palli	1 do pale and palish cut biscuits, 5s. 5½d.; 1 case heated scrap and lump rejections, 4s.
Ingoya	5 do fine pale to darkish biscuits, 5s. 7d.; 2 cases good palish to darkish pressed scrap, 4s. 6¼d.
Langsland	5 do fine palish to darkish biscuits, 5s. 7d.; 4 cases good darkish to dark biscuits, 5s. 6¾d.
Culloden	6 do fine pale to darkish biscuits, 5s. 7d.; 5 cases good palish pressed crêpe, 5s. 1¼d.; 2 cases ditto, very dark, 4s. 9¼d.
Ellakande	2 do good palish to darkish biscuits, 5s. 7d.
Nikakotua	3 do good palish to darkish sheet, 5s. 7d.

STRAITS SETTLEMENTS.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
B.R.R. Co., Ltd.	9 cases darkish crêpe, 4s. 9¾d.; 3 cases ditto, darker and inferior, 4s. 8d.
Sungei Krudda	8 do good palish to darkish scrap, 4s. 4½d.
S.K.S.	1 do good palish scrap, 4s. 4d.
Highland Est.	11 do good darkish scored sheet, 5s. 7d.; 3 cases palish to darkish crêpe, 5s. 4d.; 3 cases darkish crêpe, 4s. 10½d.; 5 cases darkish to black crêpe, 4s. 10d.
R.M.P. Ltd. (in Estate mark)	5 do good palish to darkish crêpe, 5s. 5d.; 19 cases darkish to dark crêpe, 4s. 10½d.
B.M.&C. D.	3 do good palish to darkish sheet, 5s. 6d.; 1 case scrap and heated biscuits, 2s. 9½d.
B.M.&C. C.	1 do rejections, 3s. 6d.; 1 bag ditto, 3s. 6d.; 1 case darkish pressed scrap, 3s. 3d.
L.E. (Muar in triangle) Straits	20 do very fine strong pressed blocks, 5s. 10d.; 1 case good darkish crêpe, 5s.; 1 case ditto darker, 4s. 10d.
S.P. (in circle)	5 do good palish to darkish scored sheet, 5s. 7d.; 1 case ditto paler, 5s. 7d.; 1 case ditto palish to darkish, 5s. 6d.; 1 case ditto darker, 5s. 6d.; 1 case darkish crêpe, 4s. 11½d.; 1 case ditto darker, 4s. 10d.
Do.	1 bag palish to darkish pressed scrap, 4s. 0½d.
F.C. (A. in triangle)	2 do palish to dark biscuits, 5s. 6d.
S.R. Co.	18 do good darkish scored sheet, 5s. 6¾d. to 5s. 7d.; 2 cases good palish pressed crêpe, 5s. 7d.; 4 cases darker, 5s. 4¼d.; 1 case thick darkish pressed crêpe, 4s. 8½d.
V.R.C.O. Klang F.M.S. (in Estate mark)	24 do fine palish to darkish small scored sheet, 5s. 6¾d.; 17 cases little darker, 5s. 6¾d.; 3 cases thick palish pressed crêpe, 5s. 4¾d.; 12 cases darker, 4s. 10d.; 1 case black, 4s. 4½d.
K (in triangle)	1 do inferior pressed scrap, 3s. 5½d.
P.S.E.	5 do fine palish sheet, 5s. 7d.
S. (in triangle)	10 do good small palish to darkish sheet, 5s. 6¾d.
R.R. Jebong	16 do fine large palish to darkish sheet, 5s. 7d.
S.B.R.C. Ltd. (in diamond)	7 do fine large palish to darkish sheet, 5s. 7¼d.

Camphor.

THE CHINESE INDUSTRY, 1905.

The business done in camphor in China, according to a Consular Report, though large compared with previous years, fell short of general expectations. The year 1905 opened under most favourable conditions ; there was a strong demand for camphor on the European markets and prices ruled high, while locally it was possible to procure the article at very profitable rates, which foreshadowed a large and lucrative business. The monopoly, too, that had existed a couple of years previously had been quashed, and the upcountry native dealers, relieved of this restriction, threw themselves energetically into the manufacture and freely contracted to supply foreign merchants at reasonable prices. A considerable number of contracts were entered into in this manner. Unfortunately, however, this state of things was not permitted to last. The officials soon interfered ; proclamations were put out closing certain districts and forbidding the manufacture and sale of camphor by private persons. This rendered the carrying out of the contracts entered into by native

manufacturers impossible. Representations to the authorities were without effect, and even claims made on them for losses which were proved to have been sustained through their direct obstruction of the trade, in violation of our treaty rights, failed to have effect, and it was with the utmost difficulty that business was carried on.

The price of camphor on the local market—from being $70 or $80 in 1904—rose to $118 per picul in January, 1905, and to $130 towards the close of the year, while during the succeeding three months it was as high as $190. During this time the contract price in the interior ruled from $60 to $100 per picul; so that had no official interference in the free manufacture of the article intervened, a very large business would have resulted. Notwithstanding all this, however, the returns show a wonderful development in the trade since the year 1902 when camphor first made its appearance in the lists of local exports.

CAMPHOR CULTIVATION IN SOUTH INDIA.

Recognised as a Special Product.

Mr. J. McKenzie, of Prospect estate, Nedivattam, having applied for remission of assessment on 60 acres of land which he proposed to plant with camphor in Prospect estate, the Collector of the Nilgiris called for remarks from the Curator, Government Gardens, Ootacamund, as to the prospect of its successful cultivation in that district and the length of time for which the product would yield no return. The latter having replied that the cultivation was worth encouraging, and that it will not yield any return till the trees were five years old, the Collector recommended that camphor be recognised as a special product, and that the cultivation be exempted from assessment for five years.

The Board having supported the Collector's recommendation, the Government have directed that the camphor tree (*Cinnamomum camphora*, F. Nees) may be recognised as a special product, and that the assessment on lands newly planted with that product in the Nilgiri plateau may be remitted for five complete years.

FIBRES.

THE BAMBOO FOR PAPER MAKING.

Mr. R. W. Sindall, who has been investigating on behalf of the India Office, the suitability of Indian fibre for paper-making purposes, expressed himself as follows in an interview with a representative of "The Paper Mill" of New York :— In my opinion, the bamboo of India may some day supplant the spruce wood now being used in the manufacture of pulp for paper-making. I have made a lengthy experiment, and have found that the bamboo is practical in the manufacture of pulp. I believe that capital can be secured. I would not be surprised if a company were soon to be formed for the purpose of establishing a pulp and paper mill in Burma. While my investigation was conducted for the Government, the Government itself has no intention of building mills, but is simply desirous of ascertaining whether or not the raw product available in that country is good and can be used in the manufacture of paper. The pulp I now have in my possession as a result of my experiments, is an excellent white piece of fibre, and compares very favourably with the spruce pulp manufactured in the United States. The rice and straw found there can also be utilised in making pulp, but the native wood, cotton-wood, is not good.

Water power in India is very scarce, and in the event that a pape mill is established in Burma steam power would have to be resorted to. Petroleum would be used as fuel, as it is obtainable there in large quantities and is reasonably heap. The greatest item of consideration in competition with American paper manufacturers would be labour. People of India, for the most part, are infernally lazy ; in fact, it is the women who do most of the work. The native of India can be employed for eight cents per day. I also investigated the matter of freight rates and found that the pulp can be shipped from Rangoon the principal sea port in the vicinity, to an English port for 1·35 dollar per ton. At the present time there are three paper mills in India, all located near Calcutta. One has a capacity of 200 tons per week and another 150 tons. The third I did not visit. On my way home I stopped at Shanghai, where I found the native Chinese manufacturing paper by hand. A unique process is employed in making this paper and from the time they start on a batch to the time it is ready for market one whole year has elapsed. The wood is beaten by hand and piled along the sides of mountains to bleach in the sun.—*Indian Planting and Gardening.*

EDIBLE PRODUCTS.

Cacao Cultivation in Ceylon. IV.

By Herbert Wright.

FERMENTATION OF CACAO.

(Illustrated.)

Object of the Process.

Briefly stated, the object of fermenting cacao seeds is to remove the sugary pulp surrounding them, to promote chemical changes within the kernels, to convert the bitter astringent taste into a sweet one, and to improve their colour, fracture, and flavour. Such changes are brought about when large numbers of seeds, fresh from the fruit, are heaped together and allowed to remain in contact with one another. Though the process involves a relative high temperature it is very rare that the latter destroys the embryo of the seed; to a certain extent fermentation is a continuation of the processes commenced in the seeds after maturity. Ordinary fermented seeds, if dried under unfavourable conditions will germinate, the prevention of such developments being one of the main objects of curing; this proves that the fermenting of cacao does not involve chemical changes harmful to the vitality of the seeds.

The necessity of, and improvement in quality effected by, the ordinary fermentation of cacao are generally acknowledged; nevertheless, some countries do as little fermenting as possible, and in some places this operation is entirely neglected. According to some authorities the purple colour and bitter taste of the unfermented dried seeds are wanted by some markets.

In 1902, several experiments were made at the Experiment Station, Peradeniya, with the object of effecting a good curing of seeds which had been fermented inside the fruit. In the first experiment the fruits were exposed to the sun for seven days until the wall was brown and brittle; the seeds were then cured in the sun, some after washing, others without washing. The cured seed prepared in this manner was dark in colour externally; internally it was very uneven in colour and not at all brittle. In a second experiment the fresh unbroken fruits were placed in a curing house, and kept at a temperature of about 100° F. for three days. The beans, fermented under such conditions, were subsequently cured in the sun as in the first experiment, and with very nearly the same results. In a third experiment fresh seeds were exposed to the sun without any fermenting, but with poor results. In none of these experiments did the results obtained justify the change in our method of fermenting. All the seeds which were fermented inside the fruit, or cured without being fermented, had to be placed along with the "black" cacao, owing to the pliable nature and uneven colour of the substance of the seed.

METHODS OF FERMENTING.

It is now necessary to describe the various methods of fermenting adopted in different cacao-growing countries. In Ceylon most cacao planters adopt what may be termed the natural method of fermenting, which consists of heaping the fresh seeds on the floor or in receptacles and covering them with leaves of the banana, ordinary cloth, or layers of these alternating with layers of earth. The fermenting floor is usually built with a slope, so that the watery products may escape during fermentation. Each heap may consist of four or more bushels of fresh seeds, which are turned over every day to prevent the temperature rising too high and to

Photo by H. F. Macmillan.

CURING CACAO IN THE SUN

Photo by H. F. Macmillan.

SHELLING CACAO FRUITS.

ensure an uniform product; a period of thirty-six hours to five days or even longer is allowed for fermentation according to the variety dealt with and the circulation of air maintained through the heated mass, after which the seeds are washed and then cured, either in the sun or in rooms supplied with hot air. The cacao planters in Ceylon do not usually separate the different varieties from one another, but more often than not ferment the seeds from fruits of the Caracas, Forastero, and Amelonado varieties in the same heap. The only selection usually made is in fermenting seeds from unripe or diseased fruits in special heaps; these are never fermented in the same heaps as the seeds from healthy mature pods. When the fruits are divided into classes comprising (1) mature healthy fruits, (2) immature healthy fruits, and (3) diseased fruits, and each fermented in separate heaps there is a slight advantage, but it is much more important to separate the first group into its component varieties. If all the varieties are fermented in one heap, the fermentation is very uneven, and the final product cannot be uniform in quality.

On some estates the coolies are trained to detect, in the freshly fermented and washed material, the purple seeds from the Forastero and Amelonado fruits from the white seeds of the Caracas variety, the former having much thicker integuments than the latter and being much darker in colour; the colour of the kernel can to some extent be distinguished through the integument in the freshly-washed seeds. This allows one to obtain uniform samples of cured cacao, but it does not obviate the uneven fermentation. The rapidity of fermentation depends to some extent on the thickness of the seed integuments; the Nicaraguan and Caracas seeds have very thin integuments, and fermentation is consequently effected much more rapidly than in the thicker-skinned seeds of the Amelonado, Calabacillo or Forastero varieties. The thick-skinned, flat, bitter, and purple seeds of Amelonado fruits require a longer period for fermentation than any other kind cultivated in Ceylon, and it appears to be erroneous to ferment all varieties in the same heap.

In addition to the ordinary or natural fermentation of cacao other methods have been brought forward, which are dependent upon maintaining the fermenting heap of seeds at a constant temperature. At the Experiment Station, Peradeniya, a series of tanks, lined with cement, have been made; on two sides of each tank are a large number of holes with an average diameter of 7·5 cm. (three inches); through each hole a perforated bamboo is pushed, the latter being of such a length as to stretch from one side of the tank to the other. By this means air can be let into or drawn through the fermenting heap according to requirements; the floor is made with a slope to one point, where a perforated sieve is placed, to allow the watery products of fermentation to escape.

M. Schulte* has devised a fermenter which allows the operator to maintain the fresh cacao seeds at a constant temperature of 60° C.; in this method the cacao is placed in specially made wood receptacles, positioned one above the other, and each made to carry six or more frames between which air spaces exist. The fresh seeds are arranged to a depth of 10 cm. on the frames, and these are then put into the fermenter. The fermenter consists of two chambers fitting tightly together, and is maintained at a temperature of 60° C. by conducting channels which allow the hot air to circulate from grates disposed at one end of the apparatus. Thermometers indicate when it is necessary to increase or decrease the temperature. It is asserted that by such an apparatus the cacao is fermented in such a manner as to produce a homogenous product, and one which is freer from acidity than most of the cacao placed on the market. M. Maurice Montet† in his criticism on the apparatus and method designed by M. Schulte

* Le procédé fermentation du cacao de M. Schulte im Hofe, Journal D'Agriculture Tropicale, No. 52, Oct. 31, 1905.

† Montet, l. c.

states, that though the results ascribed to this process are possible, the expense and the skilled assistance necessary to supervise the work, are such as to make the process of little value to cacao planters in most parts of the tropics. Furthermore, it has been pointed out that the cacao on the public market is often classed and valued more according to the countries from which it has been obtained than the method of fermentation adopted; this, though correct to a certain degree, should not discourage the introduction of new and better methods of fermenting, as it is obvious from the present range in value of cacao from any one country that the better qualities will ultimately receive recognition.

FERMENTING IN TROPICAL AMERICA.

The time taken to effect a good fermentation in parts of Central America varies according to the variety dealt with and the methods adopted. In Nicaragua the seeds from Criollo and Lagarto fruits are fermented for two days and the Trinitario seeds about four to five days; in Salvador the seeds are usually fermented for one or two days, and the same length of time appears to be allowed for the varieties in Guatemala.

FERMENTING IN SURINAM, VENEZUELA, ETC.

Preuss* is of the opinion that the cacao varieties grown in Cameroon are not inferior to those cultivated in Surinam, though the cacao exported from the latter place is the better one. He attributes the bitter taste and sour smell of much of the Cameroon cacao to the want of efficient fermenting, and ascribes the good qualities of the cacao from Surinam to the systematic fermenting which is adopted. The fermenting chambers in Surinam consist of series of compartments, often eight in a series, and some measuring 1.5 metres in breadth, 2.25 m. in depth and 1.7 m. in height; these chambers are made of wood, provided with an intervening air space between one another, and constructed with sloping floors. In fermenting, one box or chamber is left empty; the others are filled with wet cacao, often to a depth of one metre, and the cacao is covered with banana leaves, and the box is then closed. The cacao is allowed to ferment in this condition for one day, when that from the chamber next to the empty one is transferred to the latter; the contents of each box, after each empty one has been well washed, are transferred to the next empty one, and by this means the cacao is well mixed and superfluous sweatings removed. Each box is again allowed to retain the fermenting cacao for one day, when the same process is again gone through; at the end of five to eight days fermentation is usually considered complete, though only long experience can teach those responsible when the desired changes have been induced.

In Surinam a temperature above 45° C. is considered to be detrimental, and all fermenting chambers are situated in places protected from the wind. The sweatings are, by means of the sloping floor, conducted to an open channel constructed of glazed earthenware, and are thus allowed to escape from the fermenting heaps of cacao. The best results are believed to be obtained by fermenting large instead of small quantities of cacao; the Surinam planters believe that the changes are more complete and better when fermenting is done in moist than in wet weather.

According to Chittenden, in Venezuela†:—"The conuquero puts his beans to drain, and forthwith exposes them to the sun for say five or six hours, then heaps and packs them up to sweat afresh until the following day, when they get five or six hours more sun and so on. Another contrivance of the small grower is that of bagging the cacao at the end of the day whilst still hot from exposure to the sun and sweating it during the night."

* Expedition nach Central=und Südamerika, by Dr. Paul Preuss, 1901.

† Cacao, by J. Hinchley Hart, Trinidad, 1900.

In Mexico, according to one authority, holes are made in the earth and covered with sacks or leaves of bananas; in these the seeds are placed and then covered by means of sacks or leaves; the material is then left till the cacao is sufficiently fermented. In Surinam, according to the same authority, the cacao is thrown into heaps in wooden sheds and then covered with banana leaves. In certain countries of South America the seeds are put into leather bags to ferment, and left suspended till the changes are complete; large casks are often used in which the fermented cacao is placed, and the casks rolled to aid in the mixing of the fermented mass. In Grenada and Trinidad, according to Van der Held, the Strickland method is employed; this requires a transference to three separate receptacles for different fermentations, the fermentation often requiring a dozen days.

FERMENTATION IN JAVA.

In the opinion of Van der Held, after his experience in Java, the cacao ferments best in receptacles of wood with the minimum quantity of air. It is not absolutely necessary that these should be constructed of closed walls, but they should be capable of being covered, and situated in places sheltered from the wind. In Java the fermentation is sometimes made in movable receptacles, the wooden walls of which are perforated in order to allow the by-products of fermentation to flow away. In the same island sometimes fixed receptacles of large dimensions are used. If the production of cacao is not very considerable, Van der Held recommends the use of small movable receptacles, which can be easily cleaned. For a large estate he recommends the following:—

Place the fermenting tubs or troughs in an amphitheatre, and have the walls made of movable planks capable of being slided into the grooves of supports. Each receptacle is two metres long, one broad and one deep, and is capable of holding ten piculs of fresh seeds. They should be arranged in such a manner as to be on the same level, in a row, and their number increased according to requirements. When the seeds have been ten to twelve hours in the upper trough they are transferred to the trough beneath, this being easily done on account of the movable planks forming the walls. When the cacao in the upper chamber is to be put below it is only necessary to raise the partition. Van der Held obtained the best results by changing the receptacles twice a day in order to avoid heating; this was done between seven and eight in the morning and four and five in the afternoon. The bottom of the chambers is perforated, the openings being about half-a-centimetre in diameter; these allow the liquids to flow away. A gutter is fixed to the floor to conduct the liquid to a central point should it be required for vinegar production.

FERMENTATION IN THE WEST INDIES.

In the Jamaica Bulletin for August, 1900, the following process is described:—"Accumulate at least 500 pods before breaking; you will get better results by having larger quantities. A simple box is made one foot deep and varying in length and width according to the quantity of cacao; the contents of 1,000 pods require a box 2 ft. 6 inches long, 2 ft. wide and 1 ft. deep (inside measurements) and will fill such a box to a depth of 9 inches. It must be constructed so that no iron nails come in contact with the cacao, for iron is attacked by the "sweatings" forming a black liquor which discolours the cacao. The bottom of the box is bored with many holes, and is raised from the ground on two blocks of wood. It should be under cover and in a clean place free from dust. No lid is required. After filling with cacao, cover with a piece of clean sacking. Each morning turn up the whole mass with the hands; the cacao which was at the side and bottom being now towards the centre. If the quantity is small, turn out to dry on the fifth day, if larger (say over 2,000 pods) on the sixth day, *i.e.*, after five full days' "sweating." Scrub out the box thoroughly, and wash and dry the sacking before beginning a fresh batch. Thus by a short fermentation of a shallow mass, with plentiful access of air,

you will get better results than by keeping the mass closely packed together in a deeper vessel. The close packing of the mass does not make it hotter; on the contrary the more air reaches the mass, up to a certain limit, the hotter the cacao will become. As prices stand at present you will not find it advisable to ferment for a longer time, but on the other hand I cannot recommend you to shorten the time by a single day as your cacao would then retain too much of its original bitter flavour." This method is interesting, but whether it is largely adopted in Jamaica or elsewhere is not quite clear.

FERMENTING CACAO IN TRINIDAD.

The fermenting of the cacao in Trinidad is, according to Preuss, carried out on very much the same principle as in Surinam, though fermenting houses in the former place are frequently only protected by a roof to keep the rain off the boxes. Many methods are adopted in the island of Trinidad. One fermenting house on La Réunion Plantation, Trinidad, consists of sixteen compartments each 1.5 metres high and about as broad, and 2 metres long. The walls are made of wood, and between each two boxes and along the sides is a layer of clay and dried grass, sometimes about 20 cm. thick, to act as a non-conductor of heat; each compartment is supplied with a lid. The boxes are filled to a depth of about one metre with fresh wet cacao, covered with a layer of banana leaves and then closed. One box is kept empty so that the seeds can be transferred at any time, and the used boxes washed out every one or two days. The seeds are first fermented for one or two days, after which they are transferred to an empty box and fermented again for a similar period. The transference from box to box is made every one or two days until fermentation is complete, eight days being generally required for ordinary Forastero seeds and fourteen days for Calabacillo.

In some districts the cacao is fermented in bags suspended in holes in the earth, the contents being repeatedly kneaded without the sack being opened; by this means fermentation is said to be affected in about five days.

Another method is that associated with Cradwick, which consists of using a cask, perforated at the bottom to allow the liquid to escape; the floor is covered with a thick layer of dried banana leaves (25 cm. in thickness), and the walls are covered with a layer of the same material. The wet seeds are placed in the cask and then covered with banana leaves and allowed to ferment; after they have fermented for about two days, those in the upper part are taken out separately and subsequently returned first to the empty cask so as to be at the bottom during the following days, and those which were previously at the bottom now occupy the upper part. This operation is again repeated after two days' fermenting. This method is said to be suitable for fermenting cacao from about one thousand fruits, but if more are used an undesirable temperature may occur; if the quantity is less, more banana leaves are used and the cacao often weighted during fermentation.

FERMENTATION IN AFRICA.

The report* of one company operating in Africa states that in the preparation of cacao very good results have been obtained by fermenting the cacao for six days, the cured product having lost much of its bitter taste and secured a higher valuation. The same persons also report that the washing of cacao, though it always gave them a clear bright colour, has now been dispensed with, as by omitting this operation they increase their weight of cacao by 8 to 10 per cent.

In West Africa, according to Johnson, the old plan of preparing the beans for market by simply drying them in the sun has been abandoned everywhere in

* Kamerun Land-und Plantagen-Gesellschaft, Hamburg, p. 581, Der Tropenflanzer, Nov. 1902.

favour of the fermenting method introduced by the Government Botanic Department. "The beans are now 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."

Various fermentation experiments have been made with the purple and bitter seeds of varieties cultivated in Cameroon, and reports have been issued which are, to a certain extent, somewhat contradictory. One authority,* however, asserts that by fermenting the seeds in a particular manner it is possible to almost entirely remove the bitter unpleasant taste so frequent in purple seeds fermented in the ordinary manner.

LENGTH OF FERMENTATION.

Though this process is considered to be of vital importance in the production of good kinds of cacao, there is a very conspicuous variation in the time allowed for fermentation, and most people calculate when fermentation is complete by the appearance of the material to the naked eye and the odour of the mass of seeds. Cacao is sometimes only fermented for two days, at other times the changes are allowed to continue for twelve or even more days, and in all cases cacao of good quality is apparently produced. It may, however, be considered safe to state that those varieties having thin integuments and white cotyledons require the minimum time, and those with thicker integuments and purple cotyledons the maximum; to the former class belong the Caracas, Nicaragua, and some forms of Forastero, and to the latter the Calabacillo, Amelonado, and inferior kinds of Forastero.

The length of time required can only be determined by practice, as the chemical and physical characters of the seeds of the same variety vary according to the plant, its diseases, and to some extent climatic conditions. It is asserted by some that the pulp which surrounds the seeds contains, in Java, more water during the west monsoon than in the east monsoon, and that in wet weather the fermentation takes place more rapidly. The time required for fermentation will also vary according to the method employed, the market for which the cacao is prepared, and the quantity being fermented. Large quantities of cacao ferment quicker than small quantities, and due allowance must be made for this.

In parts of Java the cacao is allowed to ferment two nights and sometimes even only one night on account of the condition of the seeds from diseased specimens. After a night of fermentation the seeds from diseased specimens may germinate and produce cacao which is for the most part broken, very light, and of bad quality. Usually healthy cacao is allowed to ferment three days.

In Java the Criollo does not usually require to be fermented more than four days. The Criollo or Caracas type in Ceylon and Trinidad does not usually require more than two days, though it is often fermented for five; the Forastero a day longer, and the Amelonado four or five days. Preuss states that the finest and sweetest cacao requires twenty-four hours and the bitter kinds six to eight days. Fermentation is considered complete when on cutting a seed transversely one notices that the cotyledons have separated and the sugary liquid occupies the spaces within the seed. On drying, the beans may be brown in colour and sweet to the taste or purple and bitter to the taste, the former being the desired characteristics on most European markets.

(To be continued.)

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* Zur Kakas—Fermentation, by Dr. A. Schulte im Hofe, Der Tropenflanzer, May, 1901.

TEA INDUSTRY IN FOOCHOW IN 1905.

REPORT BY MR. CONSUL HERBERT F. BRADY.

In spite of its continuous decline tea still forms by far the largest article of export of Foochow. The decline in the present year appears more marked than ever, the total export being valued at £386,076, as compared with £622,744 in the preceding year; this may be accounted for in some measure by the fact that at the opening of the market the price demanded for Oolongs by the native dealers was more than the foreign buyers were prepared to give, which resulted in both parties holding aloof, and little or no business in this variety of tea being done until the beginning of the present year (1906), whereas, as a rule, the bulk of shipments go forward during November and December; the whole of the last year's crop is therefore practically excluded from the present returns. In the prosperous days of the tea trade of some 30 years ago the value of the tea exported from Hankow and Foochow (China's two great tea centres) was estimated to be worth £7,000,000 or £8,000,000 more or less equally divided between the two ports. In 1876 the total export from Foochow amounted to 561,168 piculs (74,822,400 lb.), of the value of £3,004,720 (*Tls.* 10,099,900), while that from Hankow amounted to 648,007 piculs (86,400,933 lb.), of the value of £4,132,903 (*Tls.* 13,892,112), at 5s. 11⅛d. the tael. The returns for Foochow for 1905 afford a striking illustration of the remarkable change that has taken place:—126,830 piculs (16,910,667 lb.), of the value of £286,076 at 3s. 1-10d. the tael; and the Hankow returns show a like decrease. The Consul quotes the following remarks of a local expert:—

"Prices paid by foreign buyers were lower than in the previous season, and might fairly be described as 'reasonable,' but, even at such prices, shipments did not give very satisfactory results. In fact it seems hopeless ever to expect satisfactory results again. Total shipments to London only amounted to 3,827,728 lb. as against 6,985,610 lb. for the previous season; yet even this small amount proved to be more than was wanted, and a great portion could only be got rid of at prices considerably below cost. The demand on the Continent of Europe showed a decided falling off, while America did not seem to want our teas at all. In 1886-87 the output of Congou was 1,451,000 half-chests; in 1905-06 it was 173,500 half-chests! What remains of the trade, except in the case of some fancy kinds, exists only on sufferance. Our teas are not wanted for themselves, but for blending with Indians and Ceylons, and are only taken when teas from those countries are not to be had at reasonable prices."

CITRATE OF LIME.

REPORT BY THE IMPERIAL INSTITUTE ON SAMPLES FROM THE SEYCHELLES.

Imperial Institute,

London S. W., 26th May, 1906.

SIR,—I have the honour to forward a report on the citrate of a lime, prepared in the Island of Silhouette, which was sent for examination to the Imperial Institute with letter No. 29/1906 of the 6th January last.

The investigation has given very promising results, in view of which the question of the production of citrate of lime upon a commercial scale in the islands is worth consideration.

I have, &c.,

WYNDHAM R. DUNSTAN.

H. E. the Governor, Seychelles.

Report on Citrate of Lime from Seychelles.

BY PROFESSOR WYNDHAM R. DUNSTAN.

A sample of citrate of lime manufactured in the Island of Silhouette was forwarded to the Imperial Institute by the Curator of the Botanic Station, Seychelles, and is referred to in a letter from the Governor, No. 29/1906, dated the 6th January, 1906, in which a report on the value of the product was requested.

Description of Sample.—The sample consisted of one pound of a pale grey powder which had a slight pleasant odour. When moistened, the citrate of lime showed a faint greyish orange-brown colour, and it gave a yellow solution when dissolved in water.

Examination of Sample.—The substance was examined in the Scientific and Technical Department of the Imperial Institute and was found to contain 84·56 per cent of citrate of lime (calcium citrate) and 0·42 per cent of free acid calculated as citric acid, these constituents being together equivalent to 66·89 per cent of crystallised citric acid. It contained a small quantity of iron salt, equivalent to 0·7 per cent of ferric oxide, and also a little nitrogenous and mucilaginous organic matter. The proportion of moisture, including water of crystallisation, was 12·57 per cent.

The analytical results show that this sample of citrate of lime is of good quality, and that it contains very little organic impurity in the form of mucilaginous or colouring matter. No excess of calcium carbonate is present, but the amount of ferric oxide is rather high, owing probably to the use of impure chalk in the preparation of the product. Care should be taken to use a white chalk free from rusty patches for the neutralisation of juice.

The amount of moisture is also rather high, viz., 12·57 per cent. Air dried citrate of lime ought to contain only about 7 to 8 per cent of moisture, and it is desirable that this percentage should not be greatly exceeded in commercial consignments.

Commercial Valuation.—A portion of the sample was submitted to a large firm of manufacturing chemists in London who use considerable quantities of citrate of lime. This firm reported that the quality of the product is extremely good, especially as regards colour, percentage of citric acid, and freedom from lime and mucilage. In these respects it is superior to many commercial samples. The chief defect is that more iron is present than usual, but, as already pointed out, this can be easily remedied in future by carefully selecting the chalk used for neutralising the juice.

The present value of citrate of lime is £70 per ton. This is a higher figure than has prevailed for a long time, and the normal value is £45 per ton delivered in London.

Conclusions and Recommendations.—It is clear from these results that this sample of citrate of lime from Seychelles is of good quality and compares very favourably with the material at present on the market. It would be desirable to prepare a commercial consignment of the product, taking precautions to avoid the presence of iron, and to forward this for sale in London so that it could be brought to the notice of manufacturers and its value definitely determined. It is of the highest importance that the citrate should be thoroughly dry before being shipped in bulk, as the effect of any dampness is to permit fermentation, which in some cases will go on to such an extent that a substance shipped as citrate of lime arrives at its destination in the form of impure carbonate. Want of care in connection with this point acted as a serious check to the Sicilian industry for many years.

WYNDHAM R. DUNSTAN.

26th May, 1906.

[A fair amount of trade is springing up in citrate of lime, prepared by adding lime juice to chalk, and Ceylon should take a share in it, the lime being abundant here.—ED.]

COTTONSEED OIL AND MEAL AS A HUMAN FOOD.

In June, 1905, it was my pleasure to bring to the attention of the Texas cottonseed crushers at their annual convention a few self-evident truths concerning the value of cottonseed meal as a breadstuff. Since that time my interest in the subject has steadily increased, and some very practical facts have been developed. In my experience with cottonseed meal as a breadstuff no disappointment has been encountered. I invite your critical judgment on the samples of cottonseed meal bread and cake distributed for your information and possible approval. I trust that you will find these specimens pleasant to the palate and entirely free from any objectionable taste or odour. But at the outset it should be clearly understood that cottonseed meal should never be used alone in bread making. In fact, pure cottonseed meal bread is a scientific absurdity, however practicable it may be from a culinary standpoint. Its composition would closely resemble cheese, being over rich in protein, and having no parallel in the world's food supplies. A combination of cottonseed meal with other recognized bread stuffs will greatly enrich the flours and meals now in use, while at the same time decreasing their cost to the consuming public. Within a short time I trust that the cottonseed crushers of the South may be able to announce the actual discovery of 4,500,000 tons of a new breadstuff fit for human consumption. If so, this material will approximate in quantity and far exceed in value the wheat crop of the largest wheat growing State in this country.

VALUE OF COTTONSEED.

Let us consider for a moment cottonseed meal, its origin, its composition, its value. This golden product is safely wrapped by "Dame Nature" in a wooden cradle that we call the hull, and here in the womb of the plant, hermetically sealed with five waterproof coverings, there is elaborated the richest of all feed stuffs and bread stuffs. This insures cleanliness and freedom from disease, but to make assurance doubly sure, we find that during the process of manufacturing the meats, the whole mass of meal is sterilized by thorough cooking in order to more perfectly express the oil. We will next compare its nutritive value with corn flour and corn meal. These are chiefly valuable for their protein, but we find that cottonseed meal contains three times as much digestible protein as the highest grade of wheat flour or the best breakfast food now upon the market. Stated percentagely we find that the nutrients run as follows :—

NUTRITIVE COMPOSITION OF STANDARD BREADSTUFFS.

(Pounds per hundredweight.)

	Water.	Protein.	Fat.	Carbohydrates.	Ash.
First patent flour ...	... 10.5	... 11.8	... 1.1	... 76.8	... 0.37
First clear grade flour	... 10.3	... 13.7	... 2.2	... 73.1	... 0.80
Corn meal	... 10.6	... 10.3	... 5.0	... 70.4	... 1.50
Cottonseed meal ...	... 8.2	... 42.3	... 13.1	... 30.0	... 7.2

The yellow colour of cottonseed meal is due to a substance known to chemists as gossypin. It affords a golden yellow dye for both silk and wool. The protein n our cottonseed meal, according to the Connecticut Station, consists largely of globulin, "agreeing in composition and general properties with the vitellin obtained from the seeds of wheat, maize, etc." Sugar is found in cottonseed meal as determined by German investigators which can be extracted with warm alcohol, obtaining about 3 per cent. of crystallizable material. To this sugar Bahm gave the name gossypose.

The above facts should encourage the scientists as well as the oil mill interests to press the introduction of cottonseed meal as a bread stuff upon the attention of our people. Will the government help? There is literally nothing in print from our English-speaking scientists to show that any investigations have

been undertaken with cottonseed meal as a human food. The introduction of macaroni wheat, its milling qualities, its value as a bread wheat has received the most careful consideration of the National Department of Agriculture, and this has resulted in the introduction and growth of durum, or hard wheats, in the great wheat growing regions of the Northwest by millions of bushels; but when we scan government literature for information concerning cottonseed meal as a human food, we seek bread only to find a stone. In the report of the Bureau of Animal Industry for 1904 there is but one line of a table devoted to cottonseed meal. This merely shows in the middle of a 3-page table its digestible nutrients and relative value. But even the figures there presented seem to be counted of no value by the authors, although out of the total list of feed stuffs given in three pages of tabulated matter to show their relative money values, Southern cottonseed meal heads the list in value per hundred pounds with the exception of a single other Southern product, peanut meal. Reckoning all of the feed stuffs of this country on their digestible features and counting the protein at 3·37 c. per pound, carbohydrates at 0.32 c. per pound, and fats at 0.56 c. per pound, it is there shown that corn is worth 50 c. per hundred pounds, wheat 57 c. oats 48 c. rice 39 c. linseed meal $1·09, and cottonseed meal $1·37. Nowhere else in this report of 632 pages is cottonseed meal given mention. But it cannot be argued that it is an insignificant product, for in 1905, according to census reports just published, there were 3,345,370 tons cottonseed meal. This should contribute somewhat to the gaiety of the nations and would minister to the welfare of the human race could this supply be commanded for the hungry peoples of the world, in condition to use it as we are now so freely doing for hogs, horses, cows, sheep and all the poultry thriving in the barnyard.

But referring again to the position of the Bureau of Animal Industry for the National Department of Agriculture which has engaged in experiments with food stuffs and digestion with livestock and with the human family in all parts of this country, it has just recently organized systematic experiments in co-operation with the Alabama Experiment Station for a careful investigation of the feeding value of cassava roots with livestock, and other experiments with the Texas Station for the investigation of rice mill products. But there exists in the minds of many scientists and officials of this country a harsh prejudice against cottonseed meal. Northern writers in the agricultural press have for years hurled their shafts of criticism against cottonseed meal, declaring it to be an active poison and dangerous at all times and in all quantities. At the recent Louisiana Exposition dairy test held in St. Louis, Southern owners of Jersey cattle were unable to induce committees having the rations in charge to use more than 1½ pounds of cottonseed meal for a cow, affirming that it would be dangerous. And yet this was the first feeding trial under government supervision in which cottonseed meal had ever been recognized as a practicable dairy feed. Some people are so slow to learn. Antagonism to the products of cottonseed may be read in nearly every annual report of the United States Dapartment of Agriculture, and yet there is no question of quality, yes, even the superiority of cottonseed products as compared with other industrial competitors. As proof positive of this assertion, read with me the following admission appearing in the Year Book of the Department of Agriculture for 1904, by L. M. Tolman, of the Division of Feeds, with reference to cotton oil. I commend this to your attention as a case of misdirected energy. He writes:—"The determination of the presence of small quantities of foreign fat in lard is exceedingly difficult and taxes the skill of the chemist to the utmost." Then in discussing the failure of ordinary tests for cottonseed oil (page 395) he confesses as follows:—"In this country cottonseed oil is the cheapest fat available, and is used to a great extent. * * * The chemist must be able to say that the lard

submitted to his inspection certainly has been adulterated—usually with cottonseed oil—or his testimony leaves a doubt. A great number of tests for cottonseed oil mixed with lard have been submitted, but practically without exception they have proven valueless." If the learned chemists cannot recognize any difference between cottonseed oil and hog lard, why, then, should the government treat cottonseed oil as an outlaw?

All persons eating cottonseed meal in combination with other bread stuffs have expressed great surprise at its rich flavour and its entire wholesomeness. On the 10th of May I had the pleasure of entertaining at my table the Executive Committee of the Texas Farmers' Congress by invitation, and these guests ate freely of cottonseed meal and wheat flour muffins, and expressed their delight, satisfaction and surprise. It is worthy of note that cottonseed meal carrying about 12 per cent. of vegetable oil requires no addition of shortening material. Furthermore, it is surprisingly amenable to all of the laws of cooking, and according to the investigations of Dr. Kilgore, it renders all other foods eaten more easily digested.

We are sometimes inclined to over-estimate the prejudice existing in the minds of our people (the laymen) against the use of cottonseed meal and cotton oil. As an indication of the truth of this assertion, permit me to call attention to the fact that about two years ago the pages of "Farm and Ranch" were open for the discussion of these topics, and facts bearing particularly upon the feeding of cottonseed meal to hogs according to the Allison method briefly stated. Since that time every issue of "Farm and Ranch" is flooded with cottonseed meal and cotton oil articles in the nature of "come-backs," and nearly all approving the more liberal use of these Southern products. As another evidence of the ease with which local prejudice may be broken down, I wish to personally testify that I have quite recently become a practical convert to the use of refined cotton oil for cooking and similar uses. I have used it for weeks and months consecutively in my home to the exclusion of hog lard. My own prejudice against cotton oil for biscuit making was deep seated, because based on unfavourable experience of some fifteen years ago. Its sickening odour, when heated was familiar and still unforgotten, so that I was convinced that cotton oil could be prepared in no way that would fit it for the best table use, even when diluted with hog lard or beef suet—a "compound lard." That early experience was reliable as far as the product on which it was based was concerned. But invention has developed a new cotton oil—an oil freed from those old impurities which gave out the rank odour.

Having used nothing but pure cotton oil as a "cooking fat" in the home for some six months, I would be untrue to my convictions and to the valuable home product derived from Southern farms, did I not confess that cotton oil is equal in all respects for cooking purposes to the best lard. Smaller amounts of the oil are needed in cooking to secure just the correct "shortening," but this advantage is appreciated and understood by the dullest cook within a two week's experience. Conviction as to its value as a cooking oil led to further experiments. If good for folks it must be good for brutes. So, when the dog was poisoned, we drenched it with cotton oil. In case of stress we ran to the can for a supply of mowing machine oil, as a matter of encouragemet to the squeaking lawn mower. It gave satisfactory results in both cases and we felt encouraged.

The best improved olive oil which reaches America from Italy is said to arry a large percentage of "American olive oil"—manufactured from the cotton-seed. I like olive oil on certain vegetables, and recklessly tried to substitute the vulgar cotton oil of American origin for the finest imported olive oil in preparing a dish of lettuce. I was even better pleased with the results. To the eye and to

the nerves of taste there was no difference between this plebeian of the cotton fields and the aristocrat of the Italian lazzaronis' olive groves. I next tried it on an intelligent visitor, who unsuspiciously ate thereof. He complimented its quality, "liked the fine flavour, and was very fond of good olive oil, etc." You may imagine his cheapened expression when told that it was "pure imported olive oil, direct—all the way from the Dallas oil mill."

Having used cottonseed meal freely in making both corn and flour muffins, biscuit, pancakes, ginger bread, dark Graham bread, together with dark cakes of all sorts, there is no reason to doubt the entire fittedness of cottonseed meal for combination with other breadstuffs. If called to reduce the foregoing scattering facts to a commercial proposition at this time—preparing cottonseed meal and placing it upon the market for consumption as a bread stuff—I would advise the organization of a special company for the specific purpose of marketing cottonseed meal in an acceptable form to the consuming public. It can be done. Were I permitted to occupy the role of prophet, I would thrust back the curtain of years and see the cottonseed meal resulting from a twenty million bale crush of cottonseed, prepared as a white wholesome flour, robbed of its yellow dye, and sold in cartons upon the markets of the world as the most valuable, the most concentrated and the highest priced flour known to commerce. When at the end of ten years the South grows twenty million bales of cotton with its twenty billion pounds of seed, then the bread value of the meal in these seeds will equal in nutritive value the present crop of thirty-three billion pounds of American wheat, for such will be the result, I am satisfied, of the continued efforts of this association of Interstate Cottonseed Crushers as it meets from year to year to consider the great economic problem that rests upon your shoulders.—(*From a Paper read before the Interstate Cottonseed Crushers' Association, Atlanta, U. S. A., by J. H. Connell.*)

Notes on Some of the Dry Grains Cultivated in Ceylon.

By J. F. Jowitt.

In November, 1905, I received through the courtesy of Mr. C. Drieberg, Superintendent, Government Stock Gardens, chiefly under their native names, a fine collection of seeds of cereals grown in Jaffna and the North of the Island, and from time to time he has kindly added to this collection. I am also indebted to him for literature and letters on the subject; amongst the letters, two particularly interesting ones from the Maniakar of Delft, the information contained in which I have availed myself of.

A portion of the seeds were at once sowed in well-trenched patana soil at an elevation of 4,500 feet, and subsequently artificially manured, but owing to the poorness of the soil and the partial failure of the monsoon did not thrive.

Other seed I sowed later in my kitchen garden at an elevation of 5,200 feet.

At such an elevation the growth has not, naturally, been luxuriant, but it has been sufficient to enable me to identify the species and varieties.

The following is a list of the Tamil names of the grains cultivated in the North, taken chiefly from a list forwarded to Mr. Drieberg by the Maniakar of Delft, to these names I have added the Sinhalese synonyms as far as I have been able to learn them and the Botanical names.

Tamil.		Sinhalese.		Varieties.	Botanical.
Mondy	...	—	...	—	Panicum Crus-galli var. frumentaceum.
Chamai	...	—	...	—	
—	...	Gojara-wala	...	—	
Kuthrai-val chamai	...	—	...	—	

Tamil.	Sinhalese.	Varieties.	Botanical.
Ellu or Chiru ...	— ...	— ...	—
Chamai ...	Heen Meneri ...	— ...	Panicum miliare
Pani Chamai ...	Meneri ...	— ...	Panicum miliaceum.
— ...	Kawalu ...	...	Setaria glauca
Tinai or ...	Tana-Thani ...	Red	Setaria italica
Tinai Chamai or	Tanakal ...	Black, not seen	
Waraku ...	Amu ...	Karal amu	Paspalum scrobiculatum.
— ...	— ...	Badu amu	not seen
— ...	— ...	Math amu	not seen
Kani-pun-pillu (Pull Paddy or Pull Rice) ...	Polu ...	— ...	Pennisetum typhoideum.
Muttu Cholam ...	Bada Irungu ...	— ...	Zea Mays.
Arise Cholum ...	Karal Irungu ...	— ...	Andropogon Sorghum.
Kaka or Karum...	— ...	— ...	do
Cholum ...	— ...	— ...	do
Irungu ...	Kalu Irungu ...	— ...	Andropogon Sorghum.
Shada ...	— ...	— ...	do
Nacheri ...	Kurakkan ...	— ...	Eleusine coracana
Codai or Karutha	— ...	— ...	—
Cappe ...	Kalu Kurakkan ...	not seen ...	do
Mari or Vellai ...	— ...	— ...	—
Cappe ...	Ella Kurakkan ...	not seen ...	do

I have also received notice of the following but have not seen them :—

Kansa Meneri S.

Val Meneri S.

Mut-tan-ga pillu T. found growing with other grains in Uva and on Kandy side, not cultivated.

Koli-chudampillu T. not cultivated, grows in paddy fields and is weeded out. Never used as a grain.

I shall be very grateful to any one who will kindly send me fresh specimens of those grasses marked "not seen," with their Tamil and Sinhalese names and the locality where collected, written on a slip of paper attached to the specimen.

Panicum Crus-galli, var. frumentaceum. appears to be cultivated by Tamils under three distinct forms, viz., Mondy, Chamai and Kuthrai-val-Chamai, and by the Sinhalese under the name of Gojara-wala.

Mondy, T.—This variety much resembles the wild species, *Panicum Crus-galli*, Marakku, S., but differs from it in its thickened crowded spikes and awnless glumes. The habit is erect, the stems are stout, leafy and much branched, leaves 18″ long by ¾″ wide in the middle.

All the varieties are characterised by a peculiar horse-shoe marking at the juncture of the blade of the leaf and its sheath. The panicle in plants grown by me is 4 inches long, composed of spikes, alternate below, on all sides of the stalk above, with tufts of bristles at their bases. The spikelets are crowded on the spikes in groups of 2—3. This is *Panicum frumentaceum*, Roxburgh, who says: "There are several varieties of it known to the Hindoo farmers. The seed is wholesome and nourishing, it is an article of diet, particularly amongst the lower classes of the natives. It yields about fifty-fold in a good soil. Cattle are fond of it." In the *Queensland Agricultural Journal* for April, 1906, Mr. F. Manson Bailey, F.L.S.

gives a drawing of it, and states that in that country it has made "a most luxuriant growth, stems 6 ft. in height, tender to the base, and should prove a valuable addition to our fodder"; he also says that it produces a useful grain.

Chamai T. (Anglice, grain).—This differs from "Mondy" in being smaller, the stems slenderer and decumbent at their bases. Leaves smaller 5—6 inches ovate-lanceolate. The panicle is somewhat similar, but the upper spikes are all set alternately on one side of the stalk and do not surround it as in "Mondy"; the tufts of bristles at the base of the spikes are often wanting.

The spikelets are crowded in groups of 2—3, but are smaller, being about 3 mm. long as against about 5 mm. in "Mondy." The small glume 1 often remains attached to the stalk, the spikelets falling away above it.

Gojara-wala, S. (gojara, edible?—wala, grass.)—This variety so closely resembles Chamai that I believe it to be the same grass slightly altered by climatic conditions. I grew it from seed kindly obtained for me from Uda Nuwara by my teamaker, Mr. J. A. Wijesingha. I also received a well-grown specimen from near Kurunegala, 4 feet in height, with the lower spikes over 2 inches long, altogether a robuster specimen than anything I have been able to grow.

The thicker stems, more flattened lower sheaths, stronger growth, somewhat longer, lighter coloured leaf, more elongate spikes, and these not so closely set with spikelets, and the more acute spikelets may constitute this a different variety.

In Four Korales and Uda Nuwara I am informed that "Gojara-wala" does not exceed 1½—2 feet in height. I am indebted to Mr. Wijesinghe who is acquainted with Tamil and Sanskrit as well as his mother tongue, for the English meanings of the names of the cereals and also for the uses made of the grains.

"Gojara-wala" is used for conjee for the morning meal; when boiled with coconut-milk, it is considered a luxury, allowed to get hard and cut into diamond shaped pieces, it is known as "Kiribath," that is milk rice.

Kuthrai-val-Chamai, T. (Horse-tail grass.)—This is a prostrate variety, the stems, 2 feet or more, stretching along the ground from a branched leafy base. Leaves 6—7 inches by $\frac{5}{8}$ of an inch, ovate lanceolate. The panicle exserted from the upper leaf is as long as it, and has a triangular flattened appearance. Spikes alternate, decreasing from below upwards, the lowest 1½ inches or more, upper about ½ inch, the upper 1½ inches of the rhachis unbranched but thickly studded with spikelets, bristles at base of spikelets very few. Spike-lets as in Chamai.

The seeds of this variety, and those of "Chamai" and "Gojara-wala" are practically indistinguishable, those of "Mondy" are considerably larger, rhomboidal ovoid, beaked, polished and striolate.

(*To be continued.*)

PLANT SANITATION.

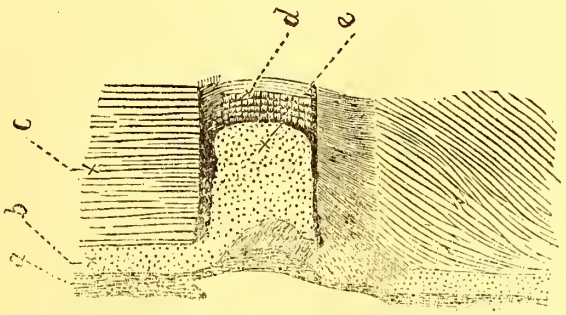
Entomological Notes.

By E. Ernest Green, *Government Entomologist.*

'Shot-hole-borer' (*Xyleborus fornicatus*) remains a serious matter of consideration with tea planters,—more particularly within a radius of ten miles around Kandy. The question is being complicated by the occurrence of wound-fungi invading the galleries of the borer, and the attacks of white ants (termites) upon the fungus-infested tissues. I have reports from certain estates that, owing to the combination of these three evils the bushes are steadily deteriorating, and there is a general cry for a radical cure. I may say, at once, that I can offer little hope of such a cure. Though nothing must be left untried, (and I have a further series of experiments in hand), I am not sanguine of finding any external application that will exterminate the borer and be at the same time practicable (from the point of cost) and harmless to the tree. It would be possible to coat the stems and branches with some viscid material that would prevent both the egress of the beetles then inside and the ingress of fresh insects from outside. I have already tried two such materials,—coal-tar and 'smearoleum.' The former completely killed the parts to which it was applied, while the latter effectually checked the development of any new shoots upon the treated surface. Such treatment fails also on the point of cost. Viscid mixtures cannot be applied by spray but must be painted on with a brush, and to answer the purpose every inch of the surface of the bark must be treated—a process occupying so much time that the cost of the work has been found to be prohibitive, even if otherwise satisfactory—which it is not. Any application that is of the nature of an air-tight coating must be injurious to such a plant as tea, in which the living tissues of the bark are unprotected by any corky superficial layer. If the stem of a healthy tea bush is even lightly scraped with the finger-nail, the green, living tissues are at once revealed. This bark contains lenticels which are functional in the respiratory processes, and any interference with their functions must injuriously effect the health of the plant. It may be said that there are possibly other mixtures that could be applied without interrupting the passage of the necessary gases. I have as yet, failed to find any such mixture that will at the same time either act as a deterrent or form a barrier against invasion by the borer. If an active poison' such as arsenic, is employed, it would be necessary that an appreciable quantity should be ingested by the insect. But the actual superficies of the exposed surface that is operated upon by the beetle is very minute, and the perforation is very generally made in the hollow of an old leaf-scar—just the very place which would be most liable to escape the action of the poison. It is, moreover, extremely doubtful if the material excavated by the beetle is taken into its alimentary system. It is more probably merely pulverized and rejected.

But though a direct cure has thus been shown to be improbable, I am fully convinced that the pest may be not only kept in check but rendered negligible by indirect cultural methods. Indeed, I have been assured that upon one estate where such methods have been systematically employed, a field of tea that has been continuously infested by the borer since the year 1892, is now giving larger yields than it ever did before. This system is simply high cultivation, resulting in a continuous healthy flow of sap throughout the plant—a condition most unfavourable to the increase of the borer. In my circular on the 'Shot-hole-borer,'

issued in 1903, I wrote as follows :—"I have repeatedly observed that a vigorous condition of the plant results in an obliteration of the earlier perforations and a tendency to choke out the insects that have more recently gained an entrance into the branches. The mouth of the tunnel is invaded by an ingrowth from the vigorous cambial tissues. New wood is then formed, covering up the old wound, and the plant is able to carry on all its functions without interruption." I am still prepared to fully endorse this statement. The accompanying figure represents an actual section through a piece of a tea branch where such an ingrowth has occurred. (*a*) shows the cortex or bark ; (*b*) the cambium ; (*c*) the woody tissue ; (*d*) section of *Xyleborus* tunnel ; (*e*) an ingrowth from the cambial tissue, blocking the entrance to the gallery. Though burning the prunings is undoubtedly the most efficient method of destroying the insects contained therein, it has been found in practice to have the serious drawback of depriving the soil of a vast amount of nitrogenous material that could be returned to it in the form of green manure. I consider that the benefit derived by the plant from a proper burial of the green prunings will far outweigh any injury that may arise from the escape of a few of the insects. If there is much heavy wood with the prunings, this may be first separated and burnt. Where the complete destruction of prunings by fire is insisted upon, it will be found necessary to replace the material by its equivalent in either green or artificial manures, at considerably enhanced cost. Failing this the tea will undoubtedly go back,—losing stamina from its inability to withstand the repeated attacks of the pest. This question of the problematical escape of some of the insects from buried prunings is rendered negligible by the fact that it is generally impossible to ensure the complete eradication of every insect from the tea bush by anything short of collar pruning. I am strongly opposed to the excessive punishment of the bushes that is sometimes inflicted in the endeavour to cut out every borer. Such an attempt is quite futile. The points of attack being quite distinct and separate from one another, it is impossible to be sure that the pest has been eradicated without cutting up every branch ; and even then there may be (and frequently are) tunnels in the main stem itself. Again,—without close examination by means of a lens—it is difficult to determine whether any particular tunnel is tenanted by the insects or has been deserted by them. I would prune an infested tea bush—equally with an unaffected one—according to its growth of wood. The object in view is the production of strong sappy shoots, and if any branch gives promise of producing such, I would spare it even if it bore visible signs of infestation. If the cut actually exposed the galleries of the insect, I would trim it down to a clean surface—to prevent the lodgement of water. Old hide-bound branches bearing only weak shoots should be ruthlessly excised.



Section of tea stem (x10), showing entrance to gallery of *Xyleborus* by ingrowth of cambial tissue.

(*a*) bark. (*b*) cambium. (*c*) woody tissue. (*d*) section of gallery. (*e*) ingrowth of cambial tissue blocking entrance to gallery.

I must own that I was, at first, insistent upon the burning of prunings and opposed to their burial. But a careful study of the results has convinced me that the latter is the sounder principle.

There is another possible cultural method that is now being made the subject of experiment. It has been suggested that dense shade, by inducing a more sappy growth, may render the plant unsuited for the propagation of the insect. The partial, checkered shade offered by Grevillea and Albizzia, as usually cultivated, is evidently non-deterrent. I propose to try the effect of a dense shade of some fast growing tree which can be readily removed or thinned out when it has served its purpose. The common 'dadap' (*Erythrina lithosperma*) commends itself as particularly suitable for this experiment. If this treatment proves successful it may be possible to exterminate the borer, in any particular field, by leaving it under shade for a year, then thinning out the shade and pruning the tea. Such treatment will necessarily result in some dimunition of the crop for the period during which the tea is under treatment, but if the desired end is attained, the temporary sacrifice will be warranted.

A correspondent has sent me detailed accounts of a treatment by which he reports that the beetles can be killed in the living stem. His method, as given in his own words, is as follows:—"For the destruction of the pest, scorch the bushes behind the pruners with torches made of coconut leaves. A few grevillea leaves or other rubbish lying about may be placed in the centre of the bush to help the flame. The torch is applied below to the centre and moved round the bush towards all the side branches—the insect will be found dead on its back in the cell. The white grubs (young beetles) are also killed. The cost of firing, with women and boys, is not more than Rs. 13 per acre, including torches. A cooly does 260 bushes in damp weather and 250 in fine weather."

I know, from experience, that a comparatively short exposure to heat is sufficient to kill the insects. Also that a tea bush rapidly recovers from the effects of fire. But there is one point that must be carefully determined before this treatment can be recommended. Will, as is very possible, the semi-scorched branches be rendered specially attractive to the beetles and so result in rapid reinfection?

In the above details of the experiment the cost may be considered very high, if not prohibitive. But I am informed that Rs. 8 of the quoted figure is expended in the torches alone. It is probable that some more economic form of torch may be devised. An absorbent material soaked in kerosene could be employed.

THE EGYPTIAN COTTON WORM.

A NATURAL AND ECONOMIC METHOD FOR PREVENTION.

By Walter Draper, F.L.S.

The serious loss to the Egyptian cotton crop, caused by the attack of insect pests, and the enormous area under this valuable summer product, render the subject of pest extermination sufficiently important to claim the attention of all cotton growers. Information of the metamorphosis of the cotton worm has been given from time to time by the Ministry of the Inferior through the Press, so that its various stages of egg, worm, chrysalis, and moth should be familiar to all.

It is well known to botanical authorities responsible for the healthy maintenance of a large collection of plants that the checking of insect pests forms an important item in their successful management. In Egypt, where huge areas of a few kinds of plants—not indigenous to the country—are annually grown agriculturally, natural enemies are at times bound to occur.

The success of hand picking eggs and worms from infected areas has been fully demonstrated and proved, and, in a European country, this work could be carried out with comparatively little assistance; but in Egypt, the tardiness of the native cultivator to clean and keep clean his crops is a great obstacle to the

successful carrying out of this important work. The application of the simple instructions drawn up recently by the author on Nedwet el Assal is a proof of this. Unfortunately, in so suitable a climate for the propagation of insect pests, the absence of a complete resting stage, and an almost continuous succession of broods, the working of insect life is such that it is not until a pest has obtained a firm hold on cultivation that the evil is brought to light.

From practical observation in the field, there is considerably more cotton worm in the country than is generally supposed, and the pest having once reached a certain stage, human agency can do little more than act as a check, it being almost impossible to entirely exterminate it. A natural method, acting in co-operation with the system at present employed, is therefore required to further the success of this important work. The occurrence of insect pests on cotton can invariably be traced to unnatural methods of cultivation, such as late and heavy sowing, which produces weak plants and small crops; overcrowding and overwatering, which provide abundance of food and conditions favourable to pests, by producing rank, succulent, shady growth, fatal to the lower bolls and the early first picking of cotton. The deteriorating effect of fertilization by inferior varieties has also to be considered. The practical agriculturist has only to look at the strong useless wood and rank foliage produced by the average crop, and to consider the strain on theland and the valuable time wasted in its production, to understand that the application of quick acting manures under the present cultural conditions would in many cases only hasten disaster by over-stimulating the plants. Moreover the folly of utilizing the unique cotton-producing characteristics of this climate and soil for producing useless wood and foliage, is apparent from the yield of last year crop.

Cotton cultivated under a suitable method, by the writer, and proved by a series of practical experiments, presented the following appearance :—

Healthy, bushy plants covered with flowers. Red-ripe wood. Foliage slightly yellow in colour. One and two bolls at the base of each leaf. Flowers well above the terminal shoot. The lower branches on the ground with bolls.

Sun and air to reach all parts of the plants. Instead of which, one finds large areas of over-watered cotton with soft green and unripe wood, dark rank foliage, few flowers, and the early bolls at the base of the plant shaded, of an unhealthy yellow colour, and falling from the absence of light and air. Still larger is the area of small, weak plants, caused by late planting, from which it is hopeless to expect a full crop.

Should further proof be required for the necessity of reform in the cotton cultivation of Egypt, it can be found in the very large number of unripe bolls to be seen on the stacks of dry cotton stalks everywhere.

The natural methods of agricultural reform in cotton cultivation, strong in their simplicity, may probably be entered into in time for next season's crop. The object of the writer is merely to endeavour to show how the work of checking *Prodenia littoralis* can be assisted by nature, rather than by reform in cultivation, although they both work hand in hand.

A NATURAL METHOD OF PREVENTION.

Dryness prevents the deposit of the egg-nidus by the female moth. Heat and dryness combined are fatal to the young cotton worms. The production of rank, succulent foliage and shade by overwatering has been mentioned; because it is not only detrimental to the yield of a full crop, but also to show that it produces abundance of food for cotton pest in the form of chlorophyll or sap in the cells between the upper and lower epidermis or skin of the leaf. This green-coloured fluid is essential to the life of the cotton worm, especially in the early stage of the hatching moreover, on such cotton foliage only are eggs deposited by the female moth

The polyphagous habit of the moth is such that in August eggs are deposited on the leaves of lebbek pear, plum, aristolochia fici, etc. Much remains to be learnt of the natural habits of cotton pests, which in the field differ considerably from those in captivity.

EGG-DEPOSITS.

One important point has been proved, viz., that the first great deposits of eggs on the cotton plants occur between the 15th of June and the 15th of July, the 20th of June to the 10th of July being the most critical period. Although the pest is somewhat gregarious, the female moth prefers to deposit her eggs on cotton a day or two after the irrigation of an area. The eggs hatch in about three days. They are not all deposited at one time; thus the age and size of the worms of this brood are very irregular. The writer has proved by experiments that early sown, naturally grown cotton on average land will stand from 30 to 40 days without water, and with excellent results in ripening the wood and producing an unusually heavy crop, but on light sandy soils this period would probably require some slight modification.

From the foregoing remarks it will be seen that cotton which can be kept dry during the egg-laying period is free from egg-deposits. Although it would scarcely be possible to apply this method at one time throughout the whole area of infected country, the irrigation of certain districts, by the present system of rotations, creates suitable places or traps for the moth to deposit her eggs. By carefully following up these rotations, the cost of labour would be considerably minimised, and the valuable time now spent in searching unlikely places might be devoted to the more thorough cleaning of egg deposits on traps formed by newly-irrigated cotton-areas.

EXTERMINATING YOUNG WORMS BY HEAT AND DRYNESS.

The worms, after hatching on the leaf, lower themselves to the ground by means of a web-like thread, and remain for a time under the soil of the ridges, feeding (during the first stake of their existence) chiefly at night on the lower leaves. It is obvious from their various ages that several pickings of worms are thus necessary to clear an infected area. In this it is impossible to prevent escapes, however carefully the work is done. Propagation from this source alone is capable of much damage, and the complete extermination of this brood by a natural method is therefore extremely important.

The crux of the question of the extermination of cotton pests by the assistance of nature, or at least the first stepping-stone to this object, is to counteract unnatural conditions of shade and dampness, by dryness and heat. The successful application of this method can only be learnt by continuous observation in the field. It has been proved by experiment, that the heat of the mid-day sun on the surface soil of unshaded ridges is often 120° to 130° F. Cotton, if allowed to flag from dryness, contains no food in its foliage for the young larvæ. It enables the sun to reach the ridges, which is fatal to the existence of the worms and fungi disease. The production of rank foliage is checked by the stoppage in the flow of sap. The green, succulent wood ripens, and produces abundance of flowers and lint, and the quality and quantity of the crop yield are considerably augmented.

When once this natural method (which applies only to cotton controlled by irrigation) has become known, and success more universally established, native growers will see the advantage of taking the matter up. Reform will naturally be slow, but the gain to the country would be enormous. The following are some of the chief pests known to attack cotton cultivated in Egypt:—

(1) *Prodenia Littoralis*—(The Egyptian Cotton Worm). Feeds on rank foliage caused by overwatering, etc.

(2) *Earias insulana.* (The Egyptian Boll-Worm). Feeds on unripe bolls of a late feeble crop, caused by unnatural conditions of cultivation.

(3) *Aphis sp.*—(The Cotton Blight) produces on succulent foliage a black fungus known as "Nedwet-el Assal."

(4) *Opogona grossipella.*—(The Small Boll-Worm) lately discovered by the writer.

(5) *Agrotis Ypsilon.*—(The Cotton Cut Worm).

(6) *Laphygma exigua.*—(The Green Cotton-Worm).

(7) *Oxycarenus halinpennis.*—(The Cotton Stainer.) A plant-bug which sucks the sap of the cotton and lives in the unripe bolls during winter.

(8) *A Root Fungus* ?—At present under observation. Appears only in July, caused by overwatering.

(9) *A Species of Red Spider.*—Migrates from berseem to cotton in May. Sucks the chlorophyll from the leaves of the cotton plant. The late sowing of cotton in the Northern portion of the Delta could be obviated and the young plants protected from the early cold and hot winds by the planting of suitable clumps of trees to act as wind screens. This would also prove of great assistance to the bean crop when in flower and prevent considerable crop loss.—*The Egyptian Gazette.*

HORTICULTURE.

HOW TO KEEP CUT FLOWERS.

It is often hard to get cut flowers, but when obtained it is still more difficult to keep them in a satisfactory condition. To arrange them tastefully and effectively requires time and thought. The immediate removal of one fading flower will often preserve the others.

Every morning flowers are taken from the vases, and beginning with the stems, refreshed by a bath of pure water—two or three minutes being long enough for the immersion—then taken out and sprinkled lightly with the hand. The water should be changed every day, and the water used for sprinkling must be fresh and pure.

Sunshine resting on cut flowers is very injurious, and the room in which they are kept should be cold rather than warm. Gas saps the very life of delicate blossoms, and a bell glass placed over them at night will be found an excellent protector.

But measures for the preservation of flowers should be taken before they reach the house. There is a great difference in their lasting powers, but the most fragile ones may be kept in excellent condition for forty-eight hours if gathered before the sun can stare them out of countenance and placed at once in tepid water. Those which show any signs of drooping should be dipped head foremost in cold water and gently shaken. Flowers that have travelled a long distance are speedily revived by this treatmeat.

Nasturtiums, heliotrope, and, above all roses, should be gathered at night, if possible. Their stems, and those of all flowers kept in water, should be cut daily.

The wistaria is a beautiful but perishable blossom that seems to pine away in disgust when transferred to the house; but the Japanese have conquered this propensity by the most heroic treatment. They burn the stems of the graceful creeper and then immerse it in spirits. Other woody plants like the hydrangea, branches of fruit blossoms, etc., can be treated in the same way.

In sending flowers away, long, narrow boxes are more desirable than round ones, and square ones are between the two in keeping powers. Tin is the best material and wood the next best; yet stout paste board often delivers its perishable contents in good condition. Especially in the case of pasteboard is a stout, rough brown paper lining, over top and all, a desirable addition after wetting it thoroughly in cold water.

The flowers must then be carefully arranged in layers, each layer reposing on its own bed of fresh green ferns made very moist. Slender sticks should be worked in under the fern beds to keep their place, and when ferns are not available cotton wool arranged in much the same way will make a good substitute. Strong-scented ones shut up in close quarters with those of more delicate perfume will almost invariably destroy the dainty charm of the latter.—*Garden and Field.*

EDUCATION.

POPULAR AGRICULTURAL EDUCATION IN JAMAICA.

The efforts made to improve agricultural education in Jamaica during the last few years cover a good deal of ground. The first obvious requirement was a suitable text-book, and in 1891 we succeeded in getting "Tropical Agriculture" from Dr. Nicholls. After a while, also at the instance of our educational authorities, the two "Tropical Readers" were compiled for use in the schools. In 1897 the Principal of Jamaica College made a tour of the Agricultural Colleges in the United States and Canada, and reported to us what other people were doing. Side by side with this we made some attempt in the Codes of 1895 to secure practical agricultural work in the schools by offering a special grant for properly cultivated school plots. During the last few years there has been steadily increasing effort to promote agricultural education both in the schools and outside of them, and the Imperial Department of Agriculture has done much to assist us both by means of its officers and by means of its publications, amongst which I am bound to mention with special gratitude Dr. Watts' "Nature Teaching."

Now, conspicuous amongst the lessons which lie on the surface of these our efforts in Jamaica are two points:—(1) the importance of preparing the ground by creating interest and sympathy in the work amongst the adult population, and (2) the importance of doing all that can be done to equip the teachers for the new requirements imposed upon them, before we expect practical results. Agricultural teaching, like other teaching, must be judged by its fruits. Although improvement in practical agriculture is only one of the fruits which we properly demand from the schools, it is a very important result.

Our attempt in 1895 to secure practical work in elementary schools was, to all intents and purposes, a failure. The results, agriculturally, tended to bring school agriculture into contempt; educationally there was little to commend. We had made the mistake of expecting seed time and harvest to proceed with equal step. At the best it would have been a plan very slow in result to work principally through the schools, for unless we induce improved cultivation amongst the population immediately productive, we postpone to far into the future that improvement, need for which in Jamaica was imperative and urgent, and constantly becoming more urgent, as the old wasteful cultivation made suitable land scarcer, and as the pressure of outside competition tightened its grasp. Nor did our plan promise sure, if slow, success, for in the absence of outside co-operation the schoolmaster's efforts evoked very little response.

Further, the outside population was at first exceedingly apathetic and indifferent, if not actively hostile. Parents objected to the soiling of the children's clothes in practical work; objected to the teachers making money out of their children's labour; contended that book learning and nothing else was what they had sent the children to school for, and that as a matter of fact they were in a better position themselves to give the practical teaching which the teachers professed. In the last contention there was often sober truth. The consequence was that the schools attempted seriously to earn the special grant, and it was often an amusing as well as a saddening spectacle to view the cultivation "where but a few torn shrubs the place disclosed" which were the subject of claim for special grants.

It would have been strange if the attitude of the peasantry had been different in this matter, and it was we who miscalculated. Emancipation was only two generations behind. With us, as in the Southern States of America, it was

followed by silent but stolid revolt against manual and industrial work, and very insufficient measures had been taken by those who were responsible to break the violence of the transition from forced labour to free citizenship. Tropical climate did not stimulate physical exertion; tropical luxuriance made continuous effort to secure bare subsistence almost superfluous. The discipline of the years of slavery had not tended to organise home life or to implant ambition towards the attainment of personal comfort. Whatever the changes and chances of life had been, food had been secure, and the emancipated peasant could not foresee the day when food might fail. As remuneration diminished, his service became more intermittent; he acquiesced in the oppression of outside circumstances or blamed the governing classes. When the neighbouring planter endeavoured to improve his living by improved machinery or more economical production, it was only the economy effected by reducing the price of labour that caught his observation; he saw no need himself to make two blades of grass grow where one had grown before.

Besides, while the great majority of the peasantry were outside of the range of educational influences, the few who had come under them thought that education meant nothing but book work of a conventional literary type; the schools were the children of the Churches, and one of their main objects was to teach people to read the Bible. With the best intentions they foredoomed themselves to failure by dissociating themselves from the home life and home interests of their scholars. The ministers themselves, full of zeal for the bettering of the conditions of life among the people, were mostly men in whom the educational traditions of the Reformation lingered on, or were drawn from the class of social reformers, at one time a large class in England, who firmly believed that increased knowledge was the only leverage needed to elevate the masses. The ministers were the men of superior education with whom the labouring classes had most intimate contact; they were able to live by their education. Small wonder then has it been that we found the general population and teachers alike needing a change of ideal as complete as those classes in America whom General Amstrong at Hampton and Booker Washington at Tuskegee have been trying to convert.

It is not surprising that in the face of this situation there is not as much in the way of practical agriculture in the schools in Jamaica to report as one might wish; perhaps there are hardly 100 schools now with school gardens and very many of those have been lately started. But I believe (and I have excellent opportunity for judging sanely) that there has been very considerable change in the attitude of the general population on the subject. We need perhaps to alter somewhat the conditions under which we offer the special grant for practical work, and a Committee is now considering this particular point. We have done what I think is the more difficult work of preparing the ground.

IMPROVING THE TEACHER.

The means by which we have succeeded in getting this encouraging change seem to have been in the main these :—

First, we have gone some way in making school agriculture attractive by improving the teacher's power to teach. No one can teach with enthusiasm what he does not know, and we had learnt that industrial and agricultural teaching power cannot be improvised. In our Training College course Latin and the higher mathematical work have been struck out; additional importance has been given to the science subjects, and particularly elementary agricultural science; more importance also to the professional subject of school management and the practice of teaching in the practising schools. At the Female Training College at Shortwood an interesting departure has been made in admitting a certain number of the girls, who fail in the competitive entrance examination, to a year's probation for domestic service

in the Institution (with opportunities for instruction at the same time) until they prove themselves fit for admission as regular students. It is easy to see what excellent results in semi-industrial training in home work are thus afforded to these future female teachers.

Besides, opportunity has been given the last few years to the teachers actually employed in the schools, who had no such opportunities during their training—sixty to eighty of them at a time—to get a few weeks' special agricultural instruction at the Mico Training College in vacation time, when the educational plant is lying idle. Part of this instruction is also practical, and in the evenings they get help in learning drawing and such other manual work as is required of them in the schools. While this does not aim at being exhaustive, it is of great assistance in starting the work on right educational lines—a point of the greatest importance.

In these ways we may reckon that nearly one-half of the principal teachers now at work in our elementary schools have received some special training in the teaching and work of agriculture. The number of schools applying for permission to undertake practical work is rapidly increasing. The number of teachers who apply for places in the special agricultural course is always much larger than can be accommodated; the difficulty is to find instructors for them while the ordinary college staff should have its holiday. I need not say that the help afforded us by the Imperial Department in supplying the services of an agricultural lecturer, Mr. Teversham, has been invaluable in this work.

THE AGRICULTURAL SOCIETY.

In the second place, the operations of our Agricultural Society must be very largely credited with the improvement in popular agricultural education. Much of its effort inevitably takes the form of preaching, and the preaching of agriculture is subject to the same disappointments as that of higher subjects; the proportion of result to effort is mostly small. We have to be comforted with the reflection that even the small result is needed, and no other way appears of obtaining it. Last year there were forty-one local branches of the Society scattered all over the Island with a total membership of 2,563. It has retained the sympathy and co-operation of the employer classes who make up its Board of Management, and many of them actively assist and guide the local Societies in their neighbourhood. The hearty co-operation of the ministers of religion has also been of great help in enlisting the confidence of the people. A nominal subscription of 1*s.* per annum secures membership in a local branch, and although these branches are as independent as they like, they get advice and help of all kinds from the Secretary and the Committee of the Central Board, which also circulates information amongst them by means of leaflets on matters which need to be brought before them from time to time. They pay only an annual 5*s.* affiliation fee to the Central Society, and as their small funds accumulate they buy tools for common use, or seeds or plants for distribution among members, or buy well-bred animals to improve the local small stock—pigs and poultry. One Society has provided itself with a stud ass, and several of them have been enterprising and capable enough to carry through successful Agricultural Shows. It may be that the establishment of the Agricultural Society will prove to be one of the biggest events in Sir Henry Blake's administration. It shows the beginnings of co-operation amongst people whose inability to co-operate and lack of public spirit have been amongst their most discouraging characteristics. The service, social and political, which they render in affording opportunity to representatives of every class in a District, to meet and talk over matters of common interest, and to get to know each other, is exceedingly valuable. Not a little of the improved popular attitude to agriculture is due to these Societies.

Besides the establishment of the local branches, several of the other enterprises of the Agricultural Society have been particularly useful. The 1*s.* annual subscription to the local branch secures to each member a monthly copy of the Society's "Journal," and 3,250 copies per month was its last reported circulation. It contains enough of useful matter to make it interesting to all classes, and amongst the lower class it is playing an important part in education in introducing the use of printed matter as a source of practical interest and information. The Agricultural Shows have been similarly serviceable. Eight shows were held last year; four others were arranged for, but were postponed in consequence of the hurricane in August, 1903. These are managed economically, for only three Shows got a grant of over £20 from the Society, and none of over £50, the rest of the money being raised locally and there are mixed Shows with prize lists varying from £50 to £200, and include exhibits of stock of all sorts and riding and driving exhibitions. Their usefulness will be increased when the instructors can devote their time at the Shows to explaining in the sheds to people interested the merits and defects of exhibits, and when we can afford to exhibit at work the appliances we encourage people to buy and use. The utmost advantage should be taken of the opportunities Shows afford as object lessons, and object lessons need explanation. The Agricultural Instructors whom I have mentioned are partly evidence of the improvement of agricultural education as well as the very useful promoters of it. A few years ago they would have been regarded as the subtle agents of the tax-collectors. We have six of these gentlemen at work, each in an appointed district for several months, and besides practical instruction and visitation they lecture to meetings under the auspices of the local branches, or, where they are none of these, under the auspices of the Minister in Church or Chapel. We often now have the encouraging symptom of impatience when they are transferred out of one district to another, and applications for their services long before they are available. Two years ago a small experiment was tried by this Society which has been very useful for the purposes that are the subject of my paper—the prize-holding scheme. Three parishes at a time, parishes in which agricultural instructors were working at the time, were taken as the area of operation. In each of these prizes of from £4 to £2 were offered for the best kept holdings which were entered in separate classes, under 20 acres, under 10 acres and under 5 acres, respectively. The judging, carried out by the instructor, with any help he might secure, was according to marks in which permanent crops, catch crops, buildings and fences and general arrangements were the chief sub-divisions. Sometimes nearly as many as 100 entries have been made in a single parish. As each competitor becomes a centre of subsequent ambition in his neighbourhood, people will, we hope, pay increased attention to the holdings on which they live, and aim by better and more permanent cultivation to keep their crops at home under supervision instead of offering facilities to the prædial thief by working in remote and isolated spots. As they appreciate the meaning of home comfort they may be expected to labour more sedulously to obtain it.

In conclusion, Mr. Williams mentions two points which he considers of the first importance with regard to future work: One is the need for a local institution of a collegiate character where scientific agriculture in all its branches can be practised and taught for the benefit of those who in the future are to be the employers of labour, and the owners or managers of estates. Education does not usually rise up, it filters down, and the most successful means of improving popular agricultural education is undoubtedly the object lesson of properly organised work under efficient management. The other point is this: to develop agriculture as part of our work in Elementary schools we need to keep it educational, as a part of the instruction that will react upon and vitalise the whole, not as a separate subject

to be specialised. To secure this it is needful that the practical agriculture be always under the control of, and be tested by, those who control, guide, and value the other educational work of the school. I see the chance of much confusion, of practical agricultural teaching being perverted to improper ends, if, as has been sometimes proposed, the practical work be delegated to purely agricultural officers. It is indeed desirable that these should teach and advise and inspire, but it is the educational value of agriculture, moral, manual, and intellectual, that is to measure out judgment as to its success in school work.

In Jamaica the difficulty is to make active and efficient and available the labour of a population of nearly 800,000 of mostly very poor people, which for various reasons is not available in the way that it is wanted, nor efficient, nor as profitable as it should be either to the labourer or the community. In improved popular education we may hope to find one of the avenues leading to the solution of our problem. There is so much that is ethical and economic to make it a very complex problem that we must be thankful if, with the help that the Imperial Department of Agriculture has given us, we may venture to hope that we have gone a little way along the right road.—*Report of J. R. Williams, Inspector of Schools, Jamaica.*

LIVE STOCK.

Poultry Notes.

By G. W. Sturgess, M.R.C.V.S.

DISEASES OF POULTRY.—(*Continued.*)

Diphtheria.—(*Continued.*)

Treatment is frequently useless and is only of benefit when commenced in the very earliest stage of the disease. The ulcers and swellings may be cleaned with a weak solution of either Cyllin, Carbolic Acid, Permanganate of Potash, Hydrogen Peroxide, Lysol, Tincture of Iodine, or Corrosive Sublimate. Any loose growths should be removed. A strong mixture of Alum, Boracic Acid and Glycerine may then be painted over the partly raw surface. Tumours over the face should be lanced and their contents squeezed out. Perchloride of Iron Solution may be used to check bleeding and a solution of Lysol or Cyllin or Corrosive Sublimate to wash out the cavities and Idoform dusted over. The eyes may be cleaned with Boracic Acid lotion or solution of Corrosive Sublimate 1 in 4000 of water. *Internally* a mixture of Chlorate of Potash, Salicylic Acid and Perchloride of Iron may be given. Soft food must be given, and stimulants if necessary. For valuable birds injections of diphtheria antitoxic serum may be tried.

The second form of diphtheritic inflammation mentioned is due to small parasites, gregarines or psorospermia. The symptoms are much the same as in the first form. The skin is more often affected—the base of the beak, nostrils, wattles earlobes, angles of the beak being commonly attacked.

The disease is easily distinguished from Chicken pox. The first signs are small seed-like nodules, soon increasing in size and becoming covered by a yellowish red scab. If the eyes are affected they become swollen and closed and may be destroyed. Death may take place in four or five weeks. The treatment is much the same as for the first form—the diseased parts may be painted with Cyllin, Lysol or Boracic Acid, Alum and Glycerine mixture. Glycerine may also be given internally with such medicines as Chlorate of Potash and Salicylic Acid.

Suppression.—All sick birds must be isolated, dead fowls burned or buried deeply with plenty of disinfectants. The runs should be thoroughly cleaned and disinfected. When new birds are purchased they should be carefully examined and suspicion aroused if there is any discharge from the nose or flow of tears.

There is another disease produced by parasites which commonly attacks poultry and resembles diphtheria. It is due to a mould fungus (thought by some to be *Monilia Candida*). It grows on the mucous membrane of the mouth in small patches of a greyish or yellowish colour resembling paste. If a patch is scraped off the skin is seen to be reddened.

The symptoms are dullness, emaciation, sour smell from the mouth, and there may be convulsions and death. Examination of the mouth at once shows the fungus growing in patches. It may be mistaken for diphtheria, however microscopical examination will reveal the parasitic filaments.

Treatment.—Remove the deposits in the mouth gently and paint the diseased patches with Alum, Boracic Acid and Glycerine mixture or turpentine and sweet oil and keep clean and dress daily for some days. The food must be soft and nutritious, and iron tonics may be given.

The Crushing of Cattle by the Kandyans.

By T. B. Pohath-Kehelpanala.

The art of crushing or "mulling" cattle as practised by the Kandyans dates from very ancient times. The operation is performed when the animal has reached its prime. This period of its life is known as "*Karanegima*," literally the age at which the neck gets fat and fleshy; it is at this stage that the animal becomes inflamed with passion.

The action of crushing called "*Karabima*" or "*Vedakan Kerima*" is performed by a skilled operator with the help of a trained assistant. It is never performed on a buffalo bull before it reaches its fifth or sixth year, nor is it undertaken before the animal has been used for ploughing. Unless the animal is subjected to this ordeal during the fattening period, it invariably becomes weak and emaciated, and utterly unfit for work; while in some cases, the effects are fatal. The act of wasting flesh and reducing the animal to leanness, is described by the Kandyans as "*Telendirima.*"

A lucky day is chosen for the operation. The month of *Il* (November) is considered a favourable period. This is the holiday season for the Kandyan agriculturist: there is abundance of fodder to be had everywhere, and the animals have no work before them until the harvesting season in March and April.

Punctual to the appointed hour, a pair of well-seasoned rounded bars of the *Kitul* (*Caryota urens*) or *Kohomba*,* like rulers, about 1½ cubits long, are laid on a "*Malbutat-Tattuwa*"—an ornamental betel tray—and are fumigated with resin. The wooden bars are tightly bound together at one end with kitul fibre. A vessel filled with saffron-water is placed close by. The animal has to have its legs bound, is thrown over on its side, and held securely to prevent its struggling.

After making a supplication to the presiding deities, the wooden bars† are placed on each side of the testicles and are firmly pressed together until the glands get entirely crushed. As a general rule, a very small portion is left unsqueezed, with the object of maintaining the health and vigour of the animal, but in the case of a buffalo that is exceptionally savage, the glands are completely crushed. The operator is known to possess a secret method of applying pressure, by which he is able to reduce the glands to varying degrees of pulpiness or consistency, so as to leave the animal after the operation, thoroughly docile, a strong worker, or with a certain amount of temper. The crushing is always attended with successful results. It restores healthful functions to the body and animals improve in strength and endurance.

When the operation is finished, saffron-water is sprinkled over the animal, and with a red-hot iron some parallel or ornamental lines are branded on the loins, flanks or tail. This is supposed to invigorate the animal and to counteract disease

As a result of the operation, severe inflamation, of course, sets in, and the animal suffers from pain, fever and exhaustion. For about a fortnight, it must be kept in a shed protected from cold, and very carefully looked after, lest, followed by the smell, crows, flies, and *Kabaragoyas*‡—especially the latter, who, attracted by the scent, travel from distances—should attack and prey upon the inflamed parts. Burnt *domba* (Calophyllum Inophyllum) ground with *Kekuna* (Canarium Zeylanicum) oil into a paste are generally rubbed over the swollen glands to allay the pain and reduce the inflammation. Sometimes, previous to the operation, the leaves of the *Pennela* (Sapuidus emarginatus) turmeric, and the tubers of the *Haran-kaha*|| are pounded to a pulp and smeared over the parts.

* Azadirachta indica. †Called *Poluwssa* by the Kandyans. ‡(Varanus Salvator.) || Curcuma longa.

At the end of a fortnight, the animal is removed to a spot where there is mud and water, and food is given at regular intervals, until the animal completely renovates his lost strength, and gets energy and tone to his body. In about two months it should be perfectly well again, and fit to begin the long spell of work before it, and to continue working till incapacitated by old age, accident or disease.

The same process is adopted in the case of black cattle also.

The operator is sometimes remunerated by one or two rupees in cash, in addititon to being handsomely entertained to *Kiribat* and *Keun*, and a meal with five curries.

VALUE OF LIVE STOCK SHOWS TO STUDENTS.

An interesting feature of the Chicago Live Stock Exhibition was the competitive judging of live stock by students of the agricultural colleges. The prizes were given by the exhibition authorities, and batches of five students each from seven colleges took part in the competition. After arranging the animals in order of merit, the boys were required to appear singly before the judges, and give their reasons for the order in which they had placed the animals. The trophy for horse-judging, previously held by the students of Iowa College, was won on this occasion by Ohio; and the one for cattle, sheep, and swine, held by Ohio, went to the Ontario College. The Ohio students led in cattle and horse-judging, Texas in swine and Ontario in sheep. The latter, however, scored the largest combined number of points in judging cattle, sheep, and swine, with Iowa second. In a maize-judging competition Iowa won a bronze trophy previously held by the Kansas Agricultural College.

The Experiment Station Record observes that the spirit of good-natured rivalry, which this competition engenders, is a healthy one, and serves as a stimulus both to students and instructors. The opportunity to measure swords with another institution is helpful to the boys and to those responsible for their instruction. The experience of taking part in such a contest is valuable, helping to develop confidence, self-reliance, and decision. Properly managed, the students' judging contest becomes an attractive and valuable feature of the show, and, incidentally, it attracts attention to the colleges and to the practical nature of their work. This annual Exhibition, which is the largest Live Stock Show in the United States, is visited by numbers of students from agricultural colleges. Seventeen States and the Province of Ontario were represented in 1905. There were about a hundred each from Illinois, Iowa, and Nebraska, large numbers from the colleges nearer by, like Wisconsin, Michigan, Indiana, and Ohio, thirty from Colorado, ten from Texas, several from Kansas, Missouri, and Louisiana, and eighteen from Ontario. Great advantage is taken of the educational facilities afforded by the collection of choice specimens of the different breeds of live stock, and the students not only watch the judging in the ring, but go round the show under the guidance of an instructor and have the points of the animals explained to them.

The agricultural colleges and experiment stations also send stock for exhibition, there being no less than 275 entries by them in ninety-five different classes, largely in the fat stock, sheep and swine classes, although there were several in the breeding classes and among the horses. Six colleges also showed in the dressed carcase classes. The grand championship of the fat stock show was won by the Iowa State College with an Angus steer, selected by Professor C. F. Curtiss about a year previously from a truck load at the stockyards, and fed at the College. The reserve champion was also won from this College. This is the fourth year that the grand championship has fallen to a college or station animal. The champion steer among the Shorthorns was from Purdue University, and Ohio State University took a large number of prizes for swine, including the championship in several classes.

The success which has attended the exhibition of stock by these Institutions has given rise to some complaint as to the competition of bodies supported or assisted by public funds with private exhibitors. This objection, however, does not seem to have met with much support, and in discussing the question the Experiment Station Record points out that, as a matter of fact, the champions for the past four years have been purchased in the open market at market prices, or by auction, and any advantage which the colleges may have had has been in the direction of ability and not of funds. In feeding the animals no secrecy is observed. The conditions are a matter of careful record, and the results are, therefore, a contribution to the practice of feeding.

Their success in open competition with the best breeders has had a great influence in popularizing agricultural education, and has produced a striking change in the attitude of the American farmer towards these institutions. Of the list of judges at the show, nine were men connected with the colleges, and they judged in nearly 150 classes. Their work was repeatedly commended for the soundness of of judgment displayed, and it was evident that they and the college instructors and authorities generally had secured the farmers' respect and confidence.—*The Journal of the Board of Agriculture*, May, 1906.

Sericulture in Ceylon, 1905-6.

By E. Ernest Green.

The silk experiment—as far as the Agricultural Society is concerned—has now been in operation for a year. A short account of its inception and progress may be useful to the Society.

At a meeting of the Agricultural Board, held on the 6th February, 1905, the Government Entomologist moved "That an experiment in Silk Cultivation be made in Ceylon by the creation of a silk-worm rearing establishment." The motion was carried and a small Committee consisting of Mr. Nicolle, Mr. Ward, and Mr. Green was appointed to consider the details. An estimate of the cost of the experiment was submitted to and approved by the Board, and a sum of Rs. 5,000 was voted for the purpose.

It was, at the same time, decided to encourage the cultivation of silk-worms amongst the natives, by the distribution of 'seed' (eggs) and by an offer to buy in the resulting crop.

Some difficulty was at first experienced in the selection of a suitable piece of land for the experiment. But, through the generosity of the Railway Department, a small block of about six acres, situated at the Peradeniya Junction, was placed at our disposal. This land was handed over in July of last year.

The services of Mr. P. N. Braine, who had privately been experimenting in sericulture for many years, and who had recently published a useful handbook on the subject, were secured for the superintendence of the experiment, under the supervision of the Government Entomologist.

The first work of the Superintendent was to re-clear the land which had been partly opened in tea and coconuts. The few tea plants were removed, but the coconut plants have been left in situ. Contracts were issued for the erection of a silkworm-rearing house, a bungalow for the Superintendent, and a small set of cooly lines. These buildings were completed by the end of November.

The silkworm-rearing house is capable of accommodating about 100,000 worms at one time. The Superintendent's bungalow consists of two rooms, with kitchen and servants' quarters.

The land was immediately planted throughout with mulberry plants, 20 feet by 10 feet, and castor seed was sown between the rows. The mulberry plants are growing well and have withstood the long drought most satisfactorily. The failure of the usual rains has, however, acted very adversely upon the growth of the castor, upon which we relied for the early raising of large stocks of Eri-worms. The greater part of the land consists of a knoll upon which the soil is very dry and contains little humus. The castor plants did not flourish under these conditions. The seeds germinated freely, but showed a weak growth. Some of them sickened and died, apparently attacked by a root-fungus; the remainder ran to seed at a very early age. There is a small strip of alluvial soil (a drained swamp) at the base of the knoll, where the plants made more satisfactory growth. But the amount of leaf obtainable from this plot has been sufficient only to maintain very limited stocks of the worms, for the provision of silkworm 'seed.' No serious attempt to raise mulberry-feeding worms will be made for some two or three years, by which time the mulberry plants should be well grown and may be heavily plucked with safety.

The higher land has been repeatedly replanted with castor, but, so far, without success. It is probable that some inexpensive form of manuring will be necessary before a proper growth of castor can be maintained. There is a natural growth of crotalaria on some parts of the land. This will be encouraged and extended for manurial purposes. Small pits are now being dug throughout the land into which the foliage of crotalaria and other waste plants is being thrown. These will eventually form pockets of good soil in which castor plants should flourish.

Whether from the poverty of the food available, or from some other obscure cause, the succeeding broods of Eri-worms have steadily deteriorated in stamina, a constantly increasing number having failed to complete their transformations Unhealthy worms have been systematically weeded out and destroyed, but, at the present moment, our stock of Eri-worms has dwindled to the vanishing point, the last batch of selected cocoons having failed to produce moths. Arrangements are now being made for the importation of fresh healthy stock from India. It has occurred to me that our system of breeding only from the white cocoons (the more valuable variety) may have had something to do with the debilitating of the stock. It may be advisable to occasionally recross with the hardier red variety. This point will require further study.

The mulberry silkworms, so far cultivated, have been of the Bengal multivoltine (many brooded) variety. This is a very hardy race and gives little trouble. The resulting cocoons are, however, inferior to those of the single brooded forms which are cultivated in Europe.

Through the good offices of Mr. Nicolle, a batch of eggs of the fine Cyprus race of mulberry worms was received in December last. These eggs commenced to hatch out almost immediately ; but in a very irregular manner, one or two worms appearing at intervals extending over more than four months. In spite of every attention, nearly all the worms died off before the final moult and less than a dozen of them formed cocoons. The moths emerged one by one, when no mates of their own kind were available. They consequently had to be crossed with the ordinary Indian race, and have produced a few hybrid eggs, the results of which will be carefully watched and kept separate. It will probably be necessary, in future, to submit imported European 'seed' to cold storage for a few weeks before allowing them to hatch out.

Attempts have been made to cross the Eri silk moth (*Attacus ricini*) with its nearly ally, the large Atlas moth (*Attacus atlas*), but, so far, without success.

We have had to contend with several enemies in the silk-worm rearing house, principally ants, rats and lizards. The racks for the rearing trays have been

isolated from the ground by standing them in shallow bowls filled with kerosene and water. But when, by mischance, one of these bowls has leaked or run dry, the ants have immediately discovered the opportunity and invaded the trays with disastrous results. Rats have, on several occasions, carried off both cocoons and caterpillars. The small geckos are ever on the watch for an opportunity to raid the trays.

With regard to the encouragement of the industry amongst the natives of Ceylon, small parcels of 'seed' have been widely distributed, with the result that over 400 lb. of cocoons have been bought in by the Society. Mr. Alexander Perera was deputed to make a tour through the villages for the purpose of collecting cocoons raised by the natives, it being thought that the collection and payment at their very doors would demonstrate to the villagers that the cultivation was worth the undertaking. This tour was satisfactory and produced nearly 100 lb. of cocoons. This means of encouragement might be extended with advantage.

One or two enterprising natives have taken up the business of collection on their own account, for resale to the Society. Other cocoons have been sent or brought in direct by the growers, who have sometimes travelled considerable distances with small parcels of cocoons worth only two or three Rupees.

The village-grown cocoons have been of somewhat poor quality, averaging probably about 1,500 to the pound. They have come in in small lots of three or four pounds at a time. This indicates that cultivators have not yet realized the fact that, to be profitable, the worms must be raised on a much more extensive scale. There is also unmistakable evidence, from the poverty of the cocoons, that the worms have been overcrowded and underfed. As a rule, the villager seems to have made no provision for the feeding of his worms. No systematic planting of castor has been undertaken; but reliance has been placed solely upon the natural growth of plants on waste land. This supply has soon been exhausted, and, at the most critical period of their growth, the worms have had to be sustained upon various substitutes which, under the press of hunger, they have been compelled to eat, the resulting cocoons being inferior in size and quality. No attempt has been made to provide sufficient accommodation for the rapidly growing worms. The consequent overcrowding induces disease resulting in the death of many worms inside the cocoons (which greatly detracts from their value); the cocoons, for want of space, are matted together and soiled by the excretions of the surrounding caterpillars.

In spite of all mistakes the industry shows promising signs of obtaining a foothold, and every means should be employed to foster it. Our endeavours should now be directed towards inducing influential natives to take up the cultivation on a more extensive scale and so form centres of influence. If necessary, they might be encouraged by personal and pecuniary assistance in the erection of suitable buildings. Such centres might also be utilized for the collection of smaller parcels of cocoons raised by the poorer natives in the neighborhood. The free distribution of castor seed (which could be imported in quantity from India) might further encourage the industry, though a large amount of seed could be collected from the plants that spring up in the neighbourhood of every village.

Until the cocoons are raised in much greater quantity than at present, no subsidiary industries—such as silk spinning and weaving (which are dependent upon large and constant supplies of the raw material)—can be expected to spring up. And it is to such industries that we must look for a steady local market for our produce.

The actual purchase and resale of cocoons has resulted in no loss to the Society, but has produced a small profit. This form of assistance should there-

fore be continued, and I see no reason why its extent should be limited in any way. The provision of an immediate market is absolutely essential. Any cessation or reduction of our efforts in this direction would inevitably result in the collapse of all interest in the matter. In time, when a constant supply of cocoons can be relied upon, private enterprise will supply a natural market. Until then, it will be necessary for the Society or the Government to provide the market. The Society has, so far, been able to dispose of their purchases locally. But should this local market fail. it will still be possible to send the material to Europe. Even should this result in a loss, such loss would be well repaid by the establishment of an important industry of direct benefit to the poorer population of the Island.

MISCELLANEOUS.

Lessons in Elementary Botany and Agriculture.

By J. C. Willis.

Multiplication of organs, or the presence of more than one in a place where we should expect only one, is not uncommon, especially among stamens, as *e.g.* in the Malvaceæ, Hypericum, &c.

Abortion, or absence of one or more members from places in which we should expect to find them, is not uncommon. In the Labiatæ and allied orders, for instance, there are only four stamens to five petals, and the missing stamen is often present as a *staminode* or rudiment.

Change of Form of the Receptacle is a frequent case. In the most primitive flowers and in a very large number now existing, the stalk or axis is more or less elongated, the carpels are at the top or *superior*, and the other organs—stamens, petals, sepals—are below them, in order, or *hypogynous*. In wild Strawberry, Potentilla, &c., the receptacle is more or less flattened on the top, so as to have a kind of $\overline{\nabla}$ shape in section.

In a good many plants the flattening is above the calyx and a *disc* is formed in the flower, but as a more general rule the calyx springs from the margin; and as a rule also the sides grow so rapidly as to form a hollow cup in which the calyx springs from the edge, the corolla and stamens from the inner slopes, and the carpels from the centre and bottom. As no other organs spring from the top of the carpels, the latter are still termed superior but the other organs are *perigynous*. (Pl. III. fig. 17 &c. K=calyx; C=corolla; A=stamens; G=carpels.) In yet other cases again the receptacle is so hollowed out as to contain the carpels, and sepals, petals, and stamens spring from it actually above the carpels. In this case they are *inferior* and the other organs are *epigynous*.

These are on the whole the most important points in the structure of a flower, and it is desirable early to become familiar with them.

Flower, or perianth, calyx, corolla, stamens may be *hypo-* *peri-* or *epi-gynous* (above) the carpels *superior* or *inferior*. Perigynous flowers may be shallowly or deeply perigynous. There may be a *disc* above the calyx in a flower. Sometimes the receptacle elongates between petals and stamens or between stamens and carpels.

Floral Symmetry is another feature that shows much variety. In many flowers the numbers of members in each whorl are the same, and each is like all the others in the whorl. Such a flower is quite symmetrical or *regular*. It more frequently happens that the symmetry is disturbed by the presence of fewer carpels than other organs, but such a flower is also called regular. If, however, some of the organs in a whorl are missing, or if they are not all exactly alike, the flower is *irregular*. Irregularity is most common in the perianth, and the terms used are given below.

The flower usually stands in the axil of a bract, and the side facing the bract is *anterior*, the other *posterior*.

We must now pass on to deal with the structure of the flower in detail.

The Bud.—An important point in classification is often the arrangement of the leaves in the bud. If they do not even meet by their edges their *aestivation*, as it s called, is *open*, if they meet by the edges, *valvate*, if they overlap, *imbricate*. A special case of the last is *twisted* when each leaf overlaps with one side and underlaps with the other, so that the bud looks twisted.

The Perianth protects the stamens and carpels from exposure before they are ripe, and aids in the attractiveness of the flower to insects. As a rule it is in two whorls, sepals and petals, which are often coherent.

It may be *hypo-* *peri-* or *epi-gynous*, of free and distinct organs *(poly-phyllous, -sepalous, - petalous)* or of coherent organs (*gamo-phyllous -sepalous, gamo* or *sym-petalous*). In the latter case the coherent part or *tube* bears the free *lobes* together forming the *limb*. The perianth may be *regular* or *irregular*, *sepaloid* (looking like a calyx) or *petaloid* (like a corolla). The sepals are commonly leafy and green, but may be woody as in the blue gum, or brightly coloured as in some Ranunculaceæ. In many epigynous flowers they are much reduced. In Compositæ, *e.g.*, dandelion or goatweed, they are often represented by a *pappus* of hairs or bristles. In Malvaceæ, some Rosaceæ, &c., there is an *epicalyx* of leaves outside the sepals and just like them. The petals are usually of some other colour than green, and of delicate texture. They may be narrowed at the base into a *claw*, may be *bifid* (notched into two), &c., *spurred* (with long hollow projection as in Viola, &c.).

The general form of a sympetalous corolla may be *tubular, funnel-shaped, belt-shaped, urn-shaped, wheel-shaped*, &c.

The stamens of a flower, taken together are termed its *androeceum*. A typical stamen consists of a stalk or *filament* bearing an *anther*, consisting of two chief lobes united by a prolongation of the stalk (*connective*). Each lobe usually contains two *pollen sacs*.

The stamens may be *hypo-* *peri-* or *epi-gynous*; *epiphyllous, episepalous, epipetalous* (adherent to perianth, sepals, petals); few, or *indefinite* (many and variable in number): *monadelphous, diadelphous, polyadelphous* (united in 1, 2, many bundles with free anthers) or *synandrous* (united, including anthers, into one mass). There may be two stamens longer than the rest *(didynamous)*.

The anther may be sessile or on a filament; it may be *versatile* (balanced transversely on the end of the stalk); it may *dehisce* or open by *slits*, by *pores*, or otherwise.

The pollen may be smooth or not, powdery or coherent, &c.; the grains as in Orchids and Asclepiadaceae may be united into masses or *pollinia*.

The carpels of a flower, taken together, form its *gynoeceum*. The simple leaf-like sporophyll occurs only in ferns, Selaginellas, &c., and in all the higher flowering plants we find the sporophyll folded inward to form a carpel, bearing the *ovules* (which will later form the seeds) inside. The hollow chamber (or often chambers if the carpels are united) is called the *ovary*, and the ovules are borne on *placentae* or cushions. The tip of the carpel is usually prolonged into a more or less thread-like style ending in a (frequently sticky) *stigma* or receptive organ for the pollen grains. Only a few plants have *apocarpous* ovaries, (*i.e.*, of free carpels); most are *syncarpous*, (of united carpels), and the arrangement of the placentas becomes of great importance. They may be *axite* (Plate III, 21) and the ovary be *muttilocutar* or many-chambered, the number of chambers corresponding to the number of carpels; they may be *parietal* or on the walls, the ovary *unilocular*; or they may be *free-centrat* with unilocular ovary. In the case of parietal placentae, they often project so far into the ovary as at first sight to chamber it.

The concrescence of the carpels may also include the styles or the styles and stigmas.

The internal structure of the ovule need not be considered here, but a few external points are important. It is borne upon the placenta by a stalk or *funicte*. When fertilised by the entrance of the tube that grows out from a pollen grain resting on the stigma, it grows into a *seed*, covered by a *seed-coat* or *testa*.

The ripe seed contains an *embryo* which under proper conditions may grow into a new plant, and there may be, between the embryo and the seed-coat, some *endosperm* or *albumen*, a whitish oily or starchy tissue, being the food upon which the young plant has to live till it has come above ground and got green leaves of its

own. When there is no endosperm, as in peas, the food is stored in the embryo. The gourds and squashes are good examples of *albuminous*, the peas and beans of *exalbuminous*, seeds.

The *gynoeceum* or *ovary* may be *superior* or *inferior* (above); *apocarpous* (if free) or *syncarpous* (if united) carpels; may have *axile, free central, parietal, basal,* or *apical* placentation; may be *uni- tri- multi-locular*, &c. (with 1, 2, 3, many chambers). The style is usually terminal, but may be lateral; it may be long, short, or absent (stigma sessile); cylindrical, thread-like, &c.; single, or as many styles as carpels. The stigma or stigmas may be sessile or on a style or styles; simple, and then often *capitate* or head-like, *lobed* (branched into large branches with but small bays between them), *bi- tri- multi-fid* (with larger branches), &c. The ovule may be *erect, ascending* (sloping upwards), *horizontal,* or *pendulous* (hanging). It may be *orthotropous* (in line with the stalk) *anatropous* (bent back on the stalk, see plate) or *campylotropous* (doubled on itself). All these characters are important in classification.

(*To be continued.*)

CO-OPERATIVE CREDIT IN THE UNITED PROVINCES, INDIA. II.

The raising of capital to finance co-operative societies has presented no difficulties since the passing of Act X of 1904. The Cawnpore Woollen Mills Company placed a sum of Rs. 10,000 at the disposal of the Registrar, for the purposes of advances to such societies. The rate of interest charged is 5 per cent, and according to the terms for repayment of principal, the amount shall be paid in ten equal annual instalments, beginning with the sixth year after the money has been drawn. Besides this, Rs. 5,000 of the advance given by Mr. D. M. Hamilton, of Calcutta, has fallen to the share of these Provinces. Apart from these two loans, local capital is rapidly becoming available. In the Bulandshahr District, the Organization Society has raised a sum of Rs. 7,000 from the local market at 6 per cent. In the Banda district, the local mahajans are anxious to invest in the district societies at the same rate. It seems very probable that all the permanent capital that may prove necessary for co-operative societies in the near future will be locally obtainable without resort to loans from Government except in special cases. The system of depositing money is also showing signs of growth, and in some districts a fair proportion of the working capital is provided in this form by the members themselves. So common is this habit of deposit becoming, that in a number of the societies recently started, the members have agreed to a compulsory half-yearly deposit, as a condition of membership of the society. These compulsory deposits, which are in the first instance of the nature of fixed deposits for five years, take on or two forms. Either they are calculated on the rent paid by the member, the rate varying in different societies from two pice to one anna per rupee, or they are made in grain at the rate of one or two pansiris for every plough in the member's use. In the latter case, the grain is sold by the punchayat in the open market and the proceeds credited to the account of the members who have made the deposit.

In both cases, the deposits bear interest at the rate of one anna in the rupee per annum. The advantages of such a system of deposit are obvious. In the first place, they are a means of increasing the working capital of the society, and allow of gradual expansion of its operations. They are also valuable as an effective means of increasing the interest taken by the members in the success of the institution, and of causing them to feel that the society is their own, not a venture started and financed by the Government and dependent on the exertions of officials for existence and success. Probably the most important of all the results which may be anticipated from the system lies in the cultivation of habits of thrift. It may reasonably be hoped that in the conclusion of the initial quinquennial period, the habit of deposit will have grown so strong, and its advantages become so apparent, that the members will volunteer to continue the custom.

Provision has been made in the model by-laws that in the years of scarcity or crop failure, or in any individual case in which the compulsory deposit would mean hardship to the depositor, the punchayat shall have the power to remit or postpone the deposit. Where general remission is sanctioned by the punchayat the fact must be reported to the Registrar for his information. It is permissible to hope that this provision, while preventing hardship in years of scarcity, will at the same time counteract the temptation to remit in years when general remission is not called for.

The two great problems which at present confront the movement are the illiteracy of the lower castes, for whom co-operation is specially fitted and specially necessary, and the absence, under existing conditions, of any connection between the co-operative credit societies and the joint stock banks. Efforts have been directed towards the solution of these problems and a method evolved, which seems to overcome the difficulty in each case. The outlines of these methods were originally sketched by Mr. Winter (at present Chief Secretary to the Local Government) in a note dated the 21st June, 1902.

The illiteracy of the lower castes is such, that it prevents any possibilities of independent societies, owing to the inability of members of such societies to keep their accounts. At the same time it is obvious that the lower castes are not in a position to command sufficient assistance from literate members of castes above them in the social scale. Any scheme by which the lower castes can be admitted to the benefits of co-operative credit must then have as an essential feature the removal of account-keeping from the sphere of the village society. The existing difficulty in bringing village societies into touch with the joint stock banks chiefly lies not in the want of tangible security, but in the smallness of the amounts with which such societies deal. Even with the most reliable security, it would not be paying business for a joint stock bank to advance a couple of hundred rupees, repayable in instalments spread over a considerable number of years. If, however, the village societies could be induced to combine for the purpose of taking loans of a considerable amount, there is every reason to believe that it would be possible for them to obtain such loans from the joint stock banks at a reasonable rate of interest.

The realization of the above two facts led in the first instance to the experiment of Central Banks to which village societies were affiliated as branches. There are now five or six such institutions and their branches number some 55 or 60. The process of formation was by fission of certain existing village banks, whose members had been recruited from many castes resident in several villages. The new societies were confined to members of the same or allied castes, and to residents of one village. In this reconstruction, it was inevitable that certain of the members of the original society could not, owing to their caste or residence, be included in any of the newly-formed small societies. To such members their initial entrance fee was returned, and their connection with the society was severed. The small societies having been formed, the members of their punchayats, or in cases where the number of the societies was considerable, their sarpanches became *ex*-officio members of a Central Society. The sole duties of this Central Society are to raise money on behalf of, and keep the accounts of, all the affiliated societies. The method of working is simple. When the Central Society is instituted and afterwards once a year, at its annual general meeting, the maximum credit to be allowed to each one of the constituent societies is fixed. This amount is recorded. Thereafter the sole duty and responsibility, that rests with the punchayat of the Central Society with reference to loans, are to see that the amount so fixed is at no time exceeded by any society. With the internal arrangements of the affiliated societies the punchayat of the Central Society has nothing to do. All applications for loans and all amounts in repayment, come up to the Central Society through the punchayats of the affiliated societies, and from the lists of payments, or lists of applications for loans,

as the case may be, the accountant at the office of the Central Society writes up his cash-book, and the ledger-accounts of the affiliated societies and of the individual members of those societies. No accounts are kept at the offices of the village societies. All that is required there is a list of the members and a list of outstanding loans. The members of the affiliated societies have little difficulty in getting these written up by some friendly literate resident of the village in those cases where there is no literate member of the Society. There seems also to be no difficulty in obtaining the necessary help in the preparation of lists of loans required and of payments for submission to the Central Society. In that Society, however, it has been found necessary to employ paid labour for account-keeping. The payment in the case of small societies takes the form of an annual gratuity, but when the capital of any Central Society becomes large and the number of affiliated societies numerous, a whole time accountant will of necessity be employed upon a regular salary.

The joint and several responsibility of the members of affiliated societies in such a scheme is two-fold. Primarily it extends to the loans due by members of their own affiliated Society. Secondly, it extends to the whole of the obligations of the Central Society. This is, of course, a necessity, as the members of the Central Society would naturally refuse to undertake the responsibility of the whole of the liabilities of that society as a personal responsibility. They are empowered by the by-laws to pledge the credit of the societies which they ex-officio represent. As a matter of fact the secondary responsibility of the members of affiliated societies would only become a reality in the case of failure of any society to carry out its primary responsibility. This is a very remote contingency, and should it arise, the reserve fund would, in any well-managed institution, suffice to meet the loss incurred through the failure of an affiliated society to perform its obligations.

The above system has been working in the case of one of the districts for the past seven months, and seems to be proving a success. Its advantages are many. In the first place, the difficulty of account-keeping in the villages is successfully overcome by the simple method of removing accounts altogether from the duties of the village punchayat. In the place of ten or fifteen small and struggling societies, in each of which account-keeping has proved or would prove a difficulty, there is one strong society, which is in a position to offer remuneration to a competent accountant. This again results in the possibility of recruiting caste societies from the lower castes, among whom literate men are extremely rare. Again, it results in a number of petty reserve funds, no one of which is of any real value as an asset of security, being replaced by one large reserve, against which it will in a short time be possible to contract temporary loans where such are necessary. Further, owing to the increase in the amounts required, it is possible for such Central Societies to go to the joint stock banks with some probability that loans will be granted.

The central system is in fact only an attempt to induce among societies co-operation of exactly the same nature as at present, in existing societies, obtains among individuals. All the advantages which are so marked in the case of individual combination for credit are still more marked in the case of a combination of societies for the same purpose.

This system is being adopted in the case of town banks which are being started in Allahabad and in Gorakphur. Instead of dealing with individual members, these banks are about to deal with groups of members, each of which is a separate society, and inside which each of the members is jointly and severally responsible with each of his fellow members for the loans granted by the town bank. In this case, however, there is no secondary responsibility. The banks are being started on share capital with limited liability.

One of the most valuable advantages which the system of central and affiliated societies offers is the ease with which the work is extended. As funds become available, the number of members of affiliated societies can be increased by recruitment, or new societies can be affiliated. The increase in the volume of account-keeping in such cases is by no means commensurate with the increase in the number of individuals to whom the benefits of co-operative credit extend. All that is requisite is a few more pages in the ledger of the Central Society. In the case of a town bank, when the available funds are more than necessary for the requirements of the town in which it works, it is possible for it to extend its operations by affiliation of small rural societies in the vicinity, or by loan to central or rural societies in the neighbourhood. In course of time it seems probable that the normal district organization will be a co-operative town bank at headquarters with branches in the tahsil headquarters and larger towns of the district, and affiliated village societies in a very large number, if not all, of the villages of the district.

Co-operative effort in the United Provinces is not confined to co-operative banking, though in the nature of things this special form is at present the most important. At the present moment there is a most interesting effort, on the part of the silk weavers of Benares, to escape from the clutches of the capitalist merchants who control the trade, and to obtain for themselves the profits which go to the middleman. A society has been formed, of which the membership roll runs into thousands, which has for its object the provision of raw material at wholesale prices to the weavers, and which will also give advances on loan to respectable men to enable them to hold the finished product until satisfactory sales can be effected. Details are being worked out. The Society will have share capital, and already some Rs. 50,000 have been promised by the weavers. The danger which has to be avoided is premature struggle with the body which at present controls the market. If the Society at first confines its efforts to the provision of material at the cheapest rates possible, and to provision of cheap credit to deserving workmen, much will have been done. Later as it gains strength and accumulates funds, it will be in a position to take over the distribution of the finished product. Its initial financial position will not justify any such attempt at the present time.

Preliminary steps are being taken for the formation of a co-operative seed depôt in the Sultanpur district. Such a society would be highly popular, and could be run with success. Its initiation has been retarded by the abnormal rise in the price of grain owing to the frost in January and February last and the unpropitious character of the monsoon.

There are other forms of co-operative effort which will doubtless be attempted in the near future. The form that co-operation may take is, however, of secondary moment. Once co-operation in any form is a success, the people may be trusted to work out other forms for themselves. The agriculturist of these Provinces has never shown himself slow to adopt any improvement which is workable and valuable, and it is not to be expected that he will be slow to adopt the principles of co-operation, once they are proved by experiment to be successful in any one direction. That these principles are sound is undoubted, and their ultimate general adoption is simply a matter of time and of careful and systematic education. The methods best suited to the conditions of the country will be ascertained by the people for whose benefit the present attempt is being made. And once the principles are known and the method of their application ascertained, a new era will dawn for the agriculturist, and for the lower classes generally.—*J. H. Simpson, I.C.S., Registrar of Co-operative Credit Societies, U. P. in Indian Agriculturist.*

CO-OPERATIVE CREDIT IN BENGAL.

While the problem of the improvement of Indian Agriculture is being attacked from the experimental and the research side by the Imperial and Provincial Departments of Agriculture, the important question of financing the agriculturist has not been forgotten. It is remarkable that the industry by which over eighty per cent. of the population live is supplied with most of its capital at a rate of interest varying from 25 to 50 per cent. per annum. Any other industry would die under such conditions, but the agricultural industry cannot die; it is the ryot who dies. He cannot turn to a more lucrative occupation when agriculture does not pay; he either starves or becomes hopelessly indebted and the slave of the money-lender. If the problem of financing agriculture can be solved, the benefit to the ryot will be greater and more direct than the saving occasioned by new methods of agriculture or the profit to be gained from a greater outturn. Without the use of capital at a reasonable rate, the agriculturist will be unable to take advantage of new ways and means. The success of the results of research and experiment depend directly on the success of the effort to supply the ryot with capital at a reasonable rate.

Cheap capital or facile credit is not necessarily a boon in itself. Switzerland has organised a system of cheap credit with the result that 60 per cent. of the land is now mortgaged. The present and past generation have merely discovered a system of robbing future generations of a portion of their means of livelihood. Any increase in comfort has been obtained at the expense of their children's children. If credit of this kind were supplied in India, the ryot, who formerly was in a position to borrow Rs. 100 from his mahajan for his daughter's marriage and pay 50 per cent. per annum for the accommodation, would simply spend more on the marriage, and so land himself deeper in debt. With credit cheap he would purchase more.

The question has thus two sides, commercial and economic. A system of finance which might prove a commercial success would not necessarily prove an economic success, but the system which promises to be an economic success must be based on commercial principles. The commercial side may be shortly stated thus:— The ryot is ready to borrow a sum of money for which he is at present paying interest from 25 to 50 per cent. or more; the majority of ryots have good security to offer for the sum which they require, while the capitalist has money to lend on good security at 6 per cent. These two have to be brought together for their mutual benefit. It would be easy and commercially profitable for the State to set up an agricultural bank provided with special summary powers for collecting its dues, but such a system would not benefit the agriculturist in the long run.

It is impossible for the large capitalist to come into direct contact with the small cultivator. The capitalist has no local knowledge of the individual, he has no agency for collecting small loans, and he could not keep millions of small accounts. There must be some intermediate organisations. In Germany this has been found in Co-operative Credit Societies, and in India an attempt is being made to create a similar organisation. This system aims at capitalizing the honesty of the villages. Where anything in the shape of a village community exists the majority of the cultivators have a character for honesty, often not extending beyond the narrow limits of the village, but within these limits most transactions take place without any written bond, the man's word being sufficient. On this honesty a certain amount of credit is based; it may be a credit of only a few rupees, but the measure is known to the villagers. They know exactly how much a man ought to spend and how much he can earn. We want, therefore, to teach the people to amalgamate this village credit and jointly borrow a sum sufficient to meet the whole village.

The capitalist does not know which cultivator is good for Rs. 5 and which for Rs. 100; he does not know who requires Rs. 20 to finance him and who requires three times that sum; he does not know who is already hopelesly involved and who can repay. It is the villagers alone who have all the information. On the other hand, the capitalist can see that the whole village is good for the total sum required. The ryots take the responsibility for dividing the money, of collecting principal and interest, and of keeping the separate accounts. This organisation of credit must be the bed rock on which any system of agricultural finance is based, and wherever a village exists, it will be found that the ryot's credit in his own village is better than his credit anywhere else. The individual may have a character for honesty in his caste, but his credit in his village will be greater than his credit with his caste.

There is no doubt that in this we have the germ of a solution of this great financial problem, but the question remains how to provide against the evils of facile credit. By organising the village and making the members jointly and severally responsible, we create a check on excessive expenditure and prevent the individual from robbing his children. The village will not lend to the individual unless they see a prospect of the money being repaid within a reasonable time, and, moreover, they will not lend unless they consider the expenditure necessary. A man is not tempted to spend on display more than he can afford when he has to run the gauntlet of public opinion, and the village will not lend him more than he can repay when they realise their joint responsibility. Further, there are so many necessary uses to which the members can put the money that they will not give out the money for unnecessary expenditure, and if the member turns to the money-lender again, his name is removed and the privilege of borrowing at a low rate ceases.

There are at present in Bengal eighty-six experimental village societies, and the majority of these show every sign of ultimate success. These pioneer societies are distributed over twenty-two of the thirty-two districts in Bengal. The capital has been raised partly from Government and Wards' Estates and partly from private sources. The societies pay from 6 to $12\frac{1}{2}$ per cent. for the money borrowed, which they lend again at from $12\frac{1}{2}$ to $18\frac{3}{4}$ per cent. The whole of the profits go to a village fund from which the original capital borrowed will be repaid, and the village will then be in a position to carry on their society with a capital of their own sufficient for all ordinary seasons. Working on these lines, steady progress has been made during the last eighteen months. Wherever a village community can be found, the scheme will succeed, but in parts of Eastern Bengal where the cultivators do not live in villages, some modification will probably be necessary. The societies have been found in villages which are not heavily indebted, because they offer the best field for initial effort, but as soon as the neighbouring villages see the benefit, they also demand similar societies in order to pay off their debts and start afresh. At present the societies are small, with a capital of Rs. 200 to Rs. 300, which is often sufficient to finance a small village, and such little societies are the best ground for observation and experience.

Three grain banks, run on co-operative lines by a zemmindar of Dacca, have attracted much public interest, and it has been recommended that such golas should be opened all over the province. The question of establishing grain golas is one of some difficulty, and so far only two have been registered in this Province. The price of grain ruled high this year, so that those with surplus stocks were eager to sell, while those with short crops had nothing to deposit. A grain bank requires much supervision, and it seems impossible to run it in Bengal as anything but a store of food grain. The different varieties of paddy sown by the cultivators of a single village are so numerous that the individual cannot rely for his seed upon the

general stock in a grain bank. Under such conditions the only method of running a seed association is to purchase the variety of seed indented for by each member, and to use the collection in the gola as food grain. The ryots readily use mixed grain for food, but seed grain must be specially selected and true to variety. For the following year a sufficient quantity of the stock must be sold and the next year's seed grain purchased. The surplus stock must be sold as soon as the new year's grain is harvested, for paddy deteriorates after one year. All these little transactions mean a large amount of labour, and it is difficult to get rid of the custom whereby every one who touches the grain gets a certain percentage. For these reasons I have come to the conclusion that on the whole it is easier to found successful money societies than seed banks; the temptations are fewer and the trouble of management is not so great.

At present, however, one experiment on a large scale is being made. In the Southal Parganas the Deputy Commissioner has carried on a grain-lending business for some years for the benefit of the ryots of the Government Estate and the Wards Estates under his charge. There are golas at four centres with a total capital of nearly 25,000 maunds of paddy. Loans were made to individual cultivators, but the business soon assumed such proportions that it got beyond the management of the Deputy Commissioner without the assistance of a special staff. The defects of the system were the difficulties of checking the accounts and the stock, the high cost of the management owing to the payments made to headmen and others for collecting the debts; and lastly, the exactions at all times of weighment and check. In consequence the rate charged was not smaller than the rate at which the ryot could borrow from the village grain dealer. Under the new rules recently drawn up, loans will in future not be made to individuals, but only to batches of ten on the joint and several bond of the whole number. If any batch chooses, it may be registered as a co-operative society. In such cases the loan will be treated as the capital of the village bank and half the interest will be credited to the village; in other cases the full interest and capital must be paid annually direct into the central gola Loans to societies are repayable in four equal annual instalments commencing from the end of the third year.

Success in all these experiments will not come at once. It is necessary to be patient. Raiffesen started his first bank in 1849, a second in 1854, and it was not till nearly forty years later that the movement made rapid strides. In Bengal there are already over three score societies working on sound principles, and this tends to show that we are on the road to a successful solution of the problem of financing agriculture.—*By W. R. Gourlay, I.C.S., Registrar of Co-operative Credit Societies, Bengal, in the Agr. Journal of India, July.*

Literature of Economic Botany and Agriculture. X.

By J. C. Willis.

Dipteryx.—Heckel & Schlagdenhauffen. Sur un nouveau copal fourni par la fruit de Dipteryx. Rev. Cult. Col., June 1903, p. 355.

Divi-divi.—See "*T.A.*" II., 1883, p. 642 &c.
D. Queensl. Agr. Jl., Aug. 1897, p. 139.
D. Agr. Ledger Veg. Prod. Ser. 51, 1899.
D. in Deutsch Ost-Africa. Tropenfl. 5, 1901, 85.
Die Kultur des D. Mitth. Amani. 1904, No. 32.
Pods of D. from India. Imp. Inst. Bull., Mar. 1904, 92.

Drug (*Miscellaneous*).—Colonial Drugs suggested for the B. P. Chem. & Drug. 3. 12. 98. p. 906.
Contributions à l'étude des plantes medicinales et toxiques. Rev. Cult. Col. 1900, p. 549.
Uber der Stammpflanze der Johimbe-rinde. Notizblatt, Berlin III. 92.
Ueber Styrax. See Just's Jahresb. 27, 1899, II. 12.
Fabiana imbricata. Do 40 & cf. later numbers of this Journal.
Guiera senegalensis. Rev. Cult. Col. 1902, 199.
Chinese Drugs. Henry in Chem. & Drug., Apr. 1902, p. 595.
Cape Aloes. Ch. & Drug., Apr. 1903, p. 664.
A useful Ceylon Drug (Eugenia Jambolana). Agr. Mag., Feb. 1903.
The Ayapana plant. Ind. Pl. & Gard., Nov. 03, p. 355.
Commercial Jaborandi. Rusby in Ch. & Drug., Dec. 1993, p. 1063.
Nux Vomica. Ind. Agr., July 1904, p. 218, Aug. p. 242.
Nux Vomica. Chem. & Drug., Sept. 1904, p. 482.
Hyoscyamus muticus from India. Bull. Imp. Inst., Jany. 1905, p. 222.
Seed of Datura Stramonium from India do 224.
Asclepias curassavica. Str. Bull. 1904, p. 464.
Malay Drugs do. 1906, 193.

Dryobalanops. Borneo, l'ancien ile du Camphre Journ. d'Agr. trop. 1903, p. 230.

Dyera. — Jelutong (D. costulata). Ridley in Str. Bull. II. 1903, p. 95.
Jelutong. Str. Bull. II. 1903, 191.

Dyestuffs (*miscellaneous*).—Flemingia congesta: Waras Dye. Agr. Ledg. Veg. Prod. Ser. 44.
Ueber den Farbematerialien in Linde. Tropenpfl. July 1899, p. 333.
Pterocarpus tinctorius. do 340.
Carthamus tinctorius (Safflower). Agr. Ledg. Veg. Prod. Ser. 86, 1904.
The natural Dyestuffs of India. Ind. Agr. 1/9/06, 274.

Ebony.—Ceylon Ebony. Broun in Indian Forester, 1899.

Elaeis.—Le Palmier à huile. Journ. d'Agr. trop., 1903, 238.
Le Palmier à huile à Dahomey. do. 264.
Ergebnisse der Probepressungen von Palm-früchten mit den Haakeschen Maschinen. Tropenfl. 8, 1904, 636.
Die Oelpalme im Bezirk Misahöhe, Togo, do. 283.
Les palmiers à huile de l'Angola. Journ. d'Agr. trop. 1905, 291.
Zur Oelpalmenkultur. Tropenpfl. 10, 637.

Erythrina.—Erythrines et bois noirs. Rev. Cult. Col. 1900, p. 440.
Une maladie du dadap. do. 1903, 343.
Le selectionnement du dadap. do 179.
Les principales especes du dadap et leurs varietes. do 182.

Eucalyptus.—What is E. oil? Ch. & Drug. 28/1/99, 149.
E. oil. Ind. Gard. & Pl., 23/11/99, 204.
Many papers by Baker and Smith, mainly in Trans. Linn. Soc. N.S.W.
Timber trees of Queensland. Q. Agr. Jl. 1899, 591, & other numbers.
Jarrah and Karri. Kew Bull. 1899, 205.
Zwei Nutzhölzer Westaustraliens. Tropenfl. 7, 1903, 103.
Culture and uses of species of E. W. Ind. Bull. IV. 1902, 145.
Adulterated E. oil. Ch. & Drug. 7/1/05, 33.
E. oil. Schimmel's Report, Oct. 1904, p. 31 & other reports.

Eucommia.—See "*T.A.*" Dec. 1899, p. 371.
Barthelat, G. J. Les latiferes de l'Eucommia ulmoides. Journ. de Bot. XIV., 1900, p. 55.
Guttapercha from a Chinese tree. Kew Bull. 1901, 89.

Euphorbia.—Almeidina (juice of E. Tirucalli). Angola Trade Report 1898.
Sudu Sudu (E. neriifolia for sweetmeats). Str. Bull. 1, 1902, p. 389.

Excoecaria.—E. Agallocha. Ind. Merc. 24/7/00, 511.

HINDOO COOLIE LABOUR IN BRITISH GUIANA.

The sugar industry of British Guiana, on the mainland of South America, and of the British Island of Trinidad, are dependent, to a very great extent, upon the supply of coolie labour brought to them from the British East Indies. These labourers have been brought in under ten-year contracts, one clause of which is that they shall be returned to their own country at the expiration of their indenture. This has led many of these immigrants to return to their old homes, although they would know that life would be much harder with them in the East Indies than in the West. A free passage home, however, has always had its attractions, and it is only now, after fifty years of experience, that in British Guiana they are about to tax the immigrant for a part of his transportation money if he desires to return home. The present provision is that the men shall pay one-half and the women one-third of the cost.

The return charge is said to be already having a good effect and a material diminution in the application for return passage is announced. The Demerara Argosy is urging that the coolies should pay their entire passage money if they wish to return, and that in this way the labour supply of the colony could be better maintained than now.

Incidental to this, we might say that the British colony of Mauritius, in the Indian Ocean, that produces about 200,000 tons of sugar, thus making it the largest sugar-producing British colony, is also dependent very largely upon this same coolie labour. The distance from Hindostan, however, is so much less to Mauritius that there is no serious difficulty there in getting an adequate supply of labour.—*Louisiana Planter.*

INDUSTRIAL EDUCATION IN AMERICA.

An important report upon the need of elementary training for the great productive industries has been presented to the Massachusetts legislature by a special commission, headed by President Carroll D. Wright as chairman. Agriculture is included among these industries, and definite provision is made for it in the general scheme by which the public school system is to be enriched and expanded along industrial and vocational lines.

The commission has been engaged for some time in an investigation of the relation of the public schools to the various industries of the State, the preparation which the schools afford for the life work of the pupils, and the economic aspects of the question. It finds that the productive industries, including agriculture, manufactures, and building depend mainly upon chance for recruiting their service. These industries are only touched educationally in their most advanced and scientific forms. No instruction whatever is furnished at public expense in the theory and practice of these occupations, and while agriculture is recognised by the State in its aid to the agricultural college, there is no preparatory work leading up to it in the same way that the high schools lead up to the other colleges. The same is true to a large extent of the schools of technology. The

children who leave school to enter employments at the age of 14 or 15 have had no training to develop their actual productive value or efficiency, and this is largely true of those who remain in school until 16 or 18. The added years, it is pointed out, are to a considerable extent lost time, so far as developing efficiency in productive employments is concerned. In the case of both classes of children the employment upon which they enter after leaving school is determined by chance.

These conditions, the commission holds, have an important economic bearing, for they tend to increase the cost of production, to limit the output in quantity, and to lower the grade in quality. Industries so recruited cannot long compete with similar industries recruited from the ranks of technically trained persons.

The commission concludes that the elements of industrial training, agriculture, domestic and mechanical sciences should be taught in the public schools, and it presents a strong argument in support of this conclusion. "The State needs a wider diffusion of industrial intelligence as a foundation for the highest technical success, and this can only be acquired in connection with the general system of education into which it should enter as an integral part from the beginning. The latest philosophy of education reinforces the demands of productive industry by showing that that which fits a child best for his place in the world as a producer tends to his own highest development physically, intellectually, and morally."

Two lines are suggested in which industrial education may be developed—through the existing public-school system and through independent industrial schools. It is recommended that cities and towns so modify the work in the elementary schools as to include instruction and practice in the elements of productive industry, as applied to agriculture and the mechanic and domestic arts, and "that this instruction be of such a character as to secure from it the highest cultural as well as the highest industrial value." It is also urged that the work in the high schools be modified "that the instructions in mathematics, the sciences, and drawing shall show the application and use of these subjects in industrial life, with special reference to local industries; . . . . . that is, Algebra and Geometry should be so taught in the public schools as to show their relations to construction, botany to horticulture, chemistry to agriculture, manufactures, and domestic science, and drawing to every form of industry."

In addition to these modifications the commission recommends that towns and cities provide new elective industrial courses in high schools for instruction in the principles of agriculture and the domestic and mechanic arts, with both day and evening courses, so as to accommodate persons already employed in trades; and furthermore, that part-time day courses be provided for children between the ages of 14 and 18 years who are employed during the remainder of the day, so that instruction in the principles and the practice of the arts may go on together.

The above relates entirely to the existing public school system, whose integrity the scheme proposes to preserve. For the more technical and advanced work the commission believes that distinctive industrial schools, separated entirely from the public school system, should be maintained. This departure is held to be entirely in accord with the policy to which the State is already fully committed, through its support of normal schools, art schools, institutes of technology, and the agricultural college. In order to secure proper instruction for teachers in the elements of agriculture, it is suggested that a normal department be established in the State agricultural college, instead of attempting to introduce the subject into normal schools or establish a separate school for that purpose.

The recommendations of the commission are embodied in a bill submitted to the legislature, which provides for the appointment of a commission on industrial education to promote this work, and proposes State aid to towns and cities for maintenance of distinctive schools for industrial training, or of industrial courses

in high or manual training schools. The hearings on this bill before the legislative committees have attracted much attention, and developed widespread interest in favour of the measure.—*U. S. Department of Agriculture, Experiment Station Record*, May, 1906.

CHEAP ALCOHOL FOR RUNNING ESTATE ENGINES.

It has been rumoured for some time that it would be only a matter of time when every farmer, or nearly every one, will be able to manufacture his own light, heat and motive power from the things which are now largely wasted. Prof. Thompson a well-known scientist, writes:—

"There are some facts which are not generally known which ought to be, namely: That alcohol is produced and sold in Cuba for from 12 to 15 cents per gallon, and that it is an excellent fuel, as I have found by tests, for the running of gas engines—taking the place of gasoline. At 15 or 20 cents a gallon, I think, it would eventually displace gasoline. Burned in similar engines it produces no smoke, soot nor disagreeable odour. Since alcohol mixes with water freely, a fire started with it is one of the easiest to extinguish. This is not the case with gasoline or even kerosene, both of which float on water and continue burning. To my mind, the farmer should be the most deeply interested in the production and use of alcohol for industrial purposes, especially in its use for farm power.

A crop that is not marketable, or partly spoiled, be it a fruit, grain or other product, could be made the source of cheap alcohol for industrial purposes. Alcohol can be stored in tanks for an indefinite period without deterioration. Whether denaturized or not, as I have stated above, at a reasonable price it is the natural fuel for all gas engines, as the amount which can be produced is practically unlimited, whereas with the increasing use of gasoline the price is sure to rise."—*Inland Farmer.*

COTTON MEAL AND COTTON SEED AS FERTILIZERS.

The following notes on the uses of cotton meal and cotton seed and the comparisons between the two, are from a paper read before the Cotton Seed Crushers' Association in America by Dr. G. J. Redding, Director of the Georgia (U.S.A.) Experimental Association:—

It is well known to you all by history and tradition, and by personal experience and participation to many much younger than myself, that for "generations before the war" and for some years thereafter cotton seed was the main reliance of the farmers of the South as a manure. Just at this point it may be well to correct some erroneous statements that gain currency in the public press ever and anon in regard to the uses and abuses of cotton seed—statements that reflect on the common intelligence of the farmers of forty years ago and more. We have often heard it said that cotton seed was considered a nuisance by our fathers and forefathers; that it was a burning and unsolved problem how to dispose of this two-thirds of the output of our crops; that the seed were permitted to rot in masses around the gin houses, or were hauled off to the swamps, or thrown into the streams in order to get rid of their objectionable affluvium. In a word, it was claimed that the farmers of the old school did not know the value of cotton seed as a feed and as a fertilizer. All of which statements are without foundation in fact, or with but little better foundation than the charge that used to be made by our friends in the North, that we cotton growers were accustomed to feed our slaves on cotton seed.

The simple truth is that on a few farms on the alluvial lands along our water courses, on which the soil was very rich—especially in nitrogenous matters—cotton seed was not found to be effective as a fertilizer, particularly on cotton. The

owners of those farms thought that their soils were so rich that cotton seed would not make them richer. We now know that the reason why cotton seed is not effective on rich virgin and alluvial soils is because the chief plant food constituent of seed is nitrogen, and that these soils are already abundantly supplied with that element.

But the farmers of the "old red hills" of Georgia and of the adjoining States were accustomed to use cotton seed as a manure for wheat, oats, corn, sugar cane, garden vegetables, etc. My personal recollections and experience of farm practices extend back to 1849, when I first guided the plow. But at corn planting time I dropped the plow-lines and was put to "dropping corn," or "dropping cotton seed." The seed was well rotted and applied at the rate of one "handful to two hills" (about ten bushels per acre).

I pass over the fact that cotton seed was also appreciated by the old-time farmer as food for the cow and death to the hog. I will only add that as late as 1870 I witnessed cotton seed selling at an executor's sale (for manurial purposes) at 27 cents per bushel of 30 pounds—a price that you seed crushers are rarely willing to give. But it is true that the farmers of that day knew nothing about cottonseed meal and cottonseed oil, for they had never seen the seed separated into its constituents. That was the dark age of cottonseed knowledge.

Cottonseed has undoubted merit as a manure, or rather as an ingredient of a fertilizer. Its conspicuous defect is the fact that its content of nitrogen is out of all just proportion to its content of phosphoric acid and potash. It is "complete" in that it contains all three of the so-called elements, but is almost as badly balanced as is stable manure. As we can now readily understand, it was most effective when applied to a crop—such as wheat, oats, corn, garden vegetables—that requires a large percentage of nitrogen. This unbalanced natural composition, while a serious defect, may be readily remedied by compositing the seed—in the soil or otherwise—with the proper quantities of acid phosphate and some form of potash.

Another defect is the necessity for partially rotting the seed in order to prevent germination. It is a fact, however, that well-rotted cottonseed is really more effective than the unrotted, crushed seed, because in that form it is much more quickly available.

Let us now examine into the merits of cottonseed meal as a fertilizer, or fertilizer ingredient.

1. Its mechanical condition is practically perfect, permitting it to be distributed with ease or readily mixed with other ingredients.

2. It is quicker in action than the raw or unrotted seed.

3. It is less bulky and less offensive to handle.

Its defects are, as in the case of the seed, that it is badly balanced, being even worse in this respect than cottonseed, containing as it does nearly three times as much nitrogen as of phosphoric acid, and nearly five times as much potash. It is too rich in nitrogen, when used alone, for any crop that is planted. But cotton meal is a remarkably convenient nitrogenous ingredient in preparing a complete and well-balanced fertilizer for any crop that requires such a fertilizer.

Up to this point it perhaps has not been manifest what direction this discussion will take and what proposition may be affirmed. I will now affirm, and hope to be able to maintain, the following propositions:—

1. That cotton meal is a cheaper and more effective fertilizer than cottonseed.

2. That a farmer should never use cottonseed directly as a fertilizer when he may exchange it for a fair equivalent of meal.

3. That, all things considered, 800 pounds of cotton meal are equivalent, as a fertilizer, to 2,000 pounds of cottonseed.

I will first give the actual analysis of cottonseed and of cotton meal and hulls: —

TABLE NO. 1.

ANALYSES OF COTTONSEED AND PRODUCTS.

Substance.	Av. phosphoric acid. Per cent.	Nitrogen. Per cent.	Potash. Per cent.	Relative com'l. Value.
Cottonseed ...	1·27	3·13	1·17	$11·83
Cotton meal ...	2·50	7·00	1·50	25·00
Cotton hulls ...	0·25	0·69	1·02	1·02

The oil and linters are not included in the above table, for the reason that neither is considered of any appreciable value for fertilizing purposes. The "Reliable Commercial Values" in the last column are based on the following valuations of the three "valuable elements": Av. phosporic acid, 5 cents per pound; nitrogen, 15 cents per pound; potash, 5 cents per pound. These will be admitted as approximately correct valuations and fair for all the purposes of this paper. Let us now present the content of each of the three "valuable elements" present in each of the three ingredients into which the whole seed is divided. Authorities differ somewhat, and the oil mills also vary in their results; but it may be accepted as a fair average that the output of one ton of cotton seed is about 740 pounds of meal and 900 pounds of hulls.

TABLE NO. 2.

TOTAL AMOUNT AND VALUES IN ONE TON OF SEED.

	Phosphoric acid. Lbs.	Nitrogen. Lbs.	Potash.	Relative com'l. Value.
740 lbs. cotton meal ...	18·50	51·80	11·10	$9·24
900 „ hulls ...	2·25	6·21	9·18	1·50
1,640 lbs. meal and hulls ...	20·75	58·01	20·28	10·77
The one ton of seed ...	25·40	62·60	23·40	11·83
Loss...	4·65	4·59	3·12	$1·06

The "loss" stated in the foregoing table must be charged to the linters, oil and waste not included, amounting to $1·06. With the facts of the analytical results just before us we are prepared to make a comparison of the relative content and value of the fertilizing ingredients. The last table shows that of the $11·83 worth of plant food contained in one ton of seed we find $9·24 worth in the meal produced from the ton of seed. In other words, the 740 pounds of meal yielded by the ton of seed lack only $2·59 of representing the total plant food content of the ton of seed. But a more direct and practical comparison is that which may be drawn between a ton of seed and a ton of meal. The farmer as well as the crusher wants to know how much cotton meal will be a fair exchange for one ton of seed, not taking account of the commercial value of the oil and of the hulls which the crusher is assumed to return.

Table No. 1 shows that one ton of cotton seed contains a relative value of phosphoric acid, nitrogen and potash of $11·83. On the other hand, one ton of cotton meal contains the same plant food elements to the amount of $25·00. By an easy calculation we find that one ton of cotton meal contains as much plant food, or fertilizing values, as are contained in 4,230 pounds of the seed. Or, to state it differently, 943 pounds of meal contain as much plant food as are found in 2,000 pounds of seed. In other words, 943 pounds of cotton meal are the fertilizing equivalent of one ton of seed. This comparison, however, does not take account of the fact that the

amounts of phosphoric acid and potash, although small, are practically unavailable to the current crop to which the seed may be applied as a fertilizer. Add to this the further facts that the cotton meal is much more promptly available to plants; its bulk and weight are much less; its mechanical condition is perfect, etc., and it may not be thought unreasonable to say that 800 pounds of meal are an equivalent to one ton of seed. For years past I have so estimated and have advised farmers accordingly, and have been sustained in a general way by the results of field experiments. As just intimated, the relative or comparative values of cottonseed and cotton meal do not rest alone on calculations based on the analyses of each. Field experiments are the true and final test of value, and these experiments are not wanting, both in fullness and significance. These experiments were conducted under my direction for the express purpose of determining the relative effectiveness of cottonseed and cotton meal, and I vouch for the correctness of the results. The first experiment was made on corn in 1891, and was reported in Bulletin No. 15 of the Georgia Experiment Station, issued in December, 1891. I quote, in part, from the bulletin, but omit the table showing the results in detail:—

It is manifestly the duty of Experiment Station workers to disabuse the minds of farmers of error, as well as to discover new truths—to disprove as well as to prove. In the effort to correct error it may sometimes result in convincing the experimenter that there is more or less truth in the supposed error. The experiment was undertaken with the sole purpose to find the truth. A piece of second year's new ground was selected. Nine plots, of three rows each, four feet wide and 209 feet long, were fertilized and planted as indicated in Table VII. Plots 0 and 9 were unfertilized. Plots 1, 3, 5 and 7 were fertilized at the rate, per acre, of—

Superphosphate	... ...	286 pounds.
Muriate of potash	... ...	37 ,,
Crushed cottonseed	... ...	381 ,,
		704 pounds.

Plots 2, 4, 6 and 8 were fertilized at the rate, per acre, of—

Superphosphate	... ...	286 pounds.
Muriate of potash	... ...	37 ,,
Cottonseed meal	... ...	143 ,,
Cottonseed hulls	... ...	180 ,,
		646 pounds.

The amounts of the different ingredients applied in the two series of plots were substantially the same, except that the 60 pounds of oil that are found in 381 pounds of crushed seed are left out in the second series, using the corresponding amounts of meal and hulls instead. The experiment then amounts practically to a direct test of the value of cotton oil as a fertilizer. If the oil has any fertilizing value, the first series of plots should show a larger yield of corn than the second series. It should be noted that in this experiment the hulls properly appertaining to the quantity of cotton meal used was also applied with the meal.

Now examine the table, plot by plot, and then compare the average yield per acre of the plots on which the crushed seed were used, with the average yield of those on which the meal and hulls—the oil left out—were used. It will be seen that the plots manured with crushed seed yielded an average of 29·2 bushels of corn per acre; while the plots without the oil yielded an average of 28·9 bushels per acre—a difference in favor of the crushed seed (containing all the oil) of three-tenths of a bushel. Of course, this difference is insignificant—no more than might have been reasonably expected had the plots been manured exactly alike. Even if admitted that the increase of three-tenths of a bushel of corn, equal to 20 cents

in value, is to be credited to the manurial effect of the oil, the gain of 20 cents' worth of corn is made at the cost of 60 pounds of oil, worth $1·75! The unfertilized check plots yielded an average of 15·8 bushels per acre.

The second experiment was also made on corn, in 1894, and was published in Bulletin No. 27 of the Georgia Experiment Station. It was planned and executed in the same manner and detail as the first described experiment, and I will give only the net results:—The fourteen alternating plots of three rows each, fertilized with crushed cottonseed, gave an average yield of 29·86 bushels per acre. The average yield of the fourteen plots fertilized with cotton meal and hulls was 30·72 bushels per acre.

The third experiment, also on corn, was made so recently as 1905 and is reported from Bulletin No. 69, published in November last. Omitting the tables the essential results are as follows:—The results are striking and should be considered as fairly conclusive, so far as the experiment can prove anything; but in connection with the previously made tests, already referred to, should be accepted as final and conclusive. By reference to Table No. 7 it will be seen that the cottonseed meal plots yielded an average of 36·39 bushels of corn per acre; while the crushed cottonseed plots gave an average of 34·07 bushels per acre, a difference in favor of the cotton meal of 2·32 bushels per acre. At $22 per ton for cotton meal and $19 a ton for cottonseed—the market prices for these products quoted in Griffin at date of this writing, the cost of the 164 pounds of cotton meal would be $1·80, and the cost of the 370 pounds of cottonseed meal would be $3·51. To state it differently and yet practically, the farmer using the cottonseed instead of the cottonseed meal would lose as follows:—

232 bushels of corn at 70 cents per bushel	$1·62
Difference between market value of the meal and seed, in favor of the meal	1·71
Loss per acre ...	$3·33
Less cost of 4 pounds of acid phosphate and 3·70 pounds of nitrate of potash	0·12
Net loss per acre ...	$3·21

Of course, it will be observed that the price of cottonseed used in the calculation is abnormally high, while the meal is about the usual price; but the result would only be proportionately less striking if the seed be priced lower. The prices above are actually those quoted at the date of this writing. It is also true that the prices of the meal and seed are *f. o. b.* at the oil mill, involving the hauling or freighting (or both) of the seed from farm to the mill, and the meal from the mill to the farm. It is not difficult to make the proper allowance for this and bring the calculation to the basis of both seed and meal delivered on the farm. The difference between the yields of the two series of plots, one series fertilized with cotton meal and the other with cottonseed, amounting to 2·32 bushels per acre, is certainly not due to any difference between the amounts of plant food in the two formulas, for these are substantially the same. But the greater yield of the cotton meal plots was doubtless due to the very much better mechanical condition of the meal, and therefore its availability, as compared with the cottonseed. The plant food contained in the hulls of the seed, although not large in amount, was probably totally unavailable to the corn plants.

CONCLUSIONS.

The results of the experiment abundantly confirmed the conclusion reached in previous experiments; that it is not expedient to apply cottonseed as a fertilizer directly to corn; but rather that the seed should be exchanged for meal and the meal used instead as a fertilizer, whenever a fair and equitable basis of exchange can be secured.

NOTE 1.—According to chemical analysis of each, 886 pounds of cotton meal are about the equivalent, in content of plant food, to 2,000 pounds of cottonseed. But owing to the superior mechanical condition of the meal and its consequently greater, or more prompt, availability, it is safe to assume that 800 pounds of meal are the full equivalent to one ton of seed. Therefore, whatever excess above 800 pounds of meal the farmer can get in exchange for a ton of seed, or by selling the seed and buying meal.

The fourth experiment, also performed in 1906, was made on cotton, and the results were considerably less unfavorable to the use of cottonseed directly as a fertilizer. I omit the tables as before and give only the essential points and results. I quote from Bulletin No. 70, issued in December, 1905 :—

In this experiment the cotton seed and meal and all other ingredients were carefully analyzed. The normal formula—355 pounds of acid phosphate (17 per cent.); 177 pounds of cottonseed meal; and 25 pounds of muriate of potash, per acre, was applied to the odd-numbered plots of five rows each on a one-acre section of land. On the even numbered plots were applied enough crushed cottonseed to supply exactly the same amount of nitrogen per acre as was contained in the 177 pounds of cotton meal. Allowance was made for the small quantities of phosphoric acid and potash contained in the seed and in the meal, and a sufficient quantity of acid phosphate and muriate of potash was added to the 409 pounds of seed to make the two formulas—one containing cottonseed meal and the other crushed cottonseed—as nearly as practicable equal to each other in content of the three valuable elements.

The cost of each formula, based on $23 per ton for meal and $16 per ton of seed, is shown in column 8 of Table No. XI., netting an excess of $1·14 per acre in the cost of the cottonseed formula.

The average yield per acre of the crushed cottonseed plats was 1,155 and of the cotton meal plots 1,157 pounds of seed cotton—a difference of only two pounds.

The excess cost of the cottonseed formula per acre being $1·14, to which add the value of the two pounds of seed cotton, or say 8 cents equals $1·22 represents the actual loss incurred in using 409 pounds of cottonseed—say one-fifth of a ton—crushed and balanced by appropriate amounts of muriate and acid phosphate, and applied as a fertilizer to one acre of cotton. Of course $1·22 multiplied by 5 equals $6·10, would correctly express the loss on each ton of cottonseed so used.

The more favorable, or rather the less unfavorable, results from the use of the cottonseed in this case, compared with those in the corn experiment of the same year, were doubtless due to two facts: (1) The year 1905 was exceptionally favorable for corn and unfavorable for cotton; and (2) cotton, requiring a much longer time to mature, the crushed cottonseed yielded up a larger proportion of its plant food to the cotton crop than to the corn crop.

It may be urged, however, that the cottonseed will add a considerable amount of humus to the soil and will gradually build up and improve its productiveness. To this it may be replied that the amount of vegetable matter supplied to the soil by an ordinary application of cottonseed would be insignificant and not enough to produce any material effect. Moreover, the value of the cotton hulls, which would contain all the humus-producing ingredients of the seed not contained in the meal, are far too valuable as animal food to be used as an amendment to the soil. The farmer could not afford to apply to the soil as an amendment or humus producer a material selling at from $6 to $8 a ton for feeding cattle, and probably worth more.

In conclusion, on the particular propositions that I have been discussing, it seems clear, both from consideration of the chemical analysis of cottonseed and cotton meal, that it is a wasteful and unwise practice to use cottonseed directly as a fertilizer, when it can be exchanged for cotton meal on a fair and equitable basis.

This brings up the question, which is the real crux of the problem, how much meal should the oil-mill man give in exchange for a ton of seed? With the given facts of analyses and the results of actual experiments in the field, together with the market price of oil and meal, there should be no real difficulty in reaching a mutually satisfactory basis of exchange between the producer and the oil-mill. The former should in no conceivable case receive less than 800 or 900 pounds of meal in exchange for one ton of seed, after allowing for the expense and labor of hauling to and from the point of delivery. The oil-mill man must get his expenses and profits for operating the mill out of the oil. It is quite evident that the value of the oil should be divided between the producing farmer and the oil-mill on a fair basis, and this basis must be determined mainly by the current market price for the oil. In my own experience I have found it much better to hold on to the seed until the approaching close of the crushing season, when the mill owner is hard up for seed to keep his machinery going. I have usually had no difficulty in exchanging on a basis varying from 1,400 to 1,800 pounds of meal in exchange for a ton of seed delivered at the mill.

I will close this paper by saying that a farmer should not use cottonseed meal as a fertilizer so long as he has cows and beef cattle to consume it. I have been insisting that he should exchange his seed for meal and use the latter as a fertilizer rather than the former. But the true policy is to use neither seed nor meal as a fertilizer if practicable to avoid such use.

Correspondence.

IMPROVED CEYLON NATIVE PEAS.

DEAR SIR,—I should be glad to know how I may procure a sample supply of the "native" peas spoken of by Dr. Willis in the first article of the current number of the *Tropical Agriculturist*. If you can assist me in this matter I shall be greatly obliged.

I am, yours faithfully,

E. MACFADYEN.

Jebong Estate, Perak, 4th October, 1906.

[The peas can, as a rule, be bought in the bazaar. The Director, Royal Botanic Gardens, Peradeniya, would be glad to buy them if requested.—ED.]

GINSENG SEED.

DEAR SIR,—Will you forgive me if I ask you to kindly inform me where I can get ginseng seed (*Panax ginseng*). I have just read an article *re* this product in your issue of November, 1905, and would very much like to experiment. I shall be very much obliged indeed for the information.

Yours truly,

I. G. F. MARSHALL.

Burmah Forests.

Thanawady, 18th September, 1906.

[Ginseng seed can at present only be easily procured, so far as I know, in the United States. The demand for ginseng is small, and I am told by one who knows China well that the Chinaman would probably not buy stuff grown abroad.—ED.]

Current Literature.

Vegetable Growing in Porto Rico.—By H. C. Henricksen of the Porto Rico Agricultural Experiment Station, issued by the Government Printing Office, Washington, U.S.A:—This is a useful little treatise on the growing of good vegetables in the tropics; and as the conditions of Porto Rico are not very unlike those of Ceylon, the information contained in the pamphlet and the methods adopted to produce a good class of vegetable may be of use to Ceylon growers. The first chapters deal with the general cultivation of soils, manures and fertilizers, and the sowing of seeds. Diseases of plants and insect enemies, and how to combat them with fungicides and arsenical insecticides, with illustrations of bucket and knapsack sprayers, are given. The rest of the work is taken up with detailed cultural directions for no less than thirty-nine different vegetables, and is illustrated with a number of well-produced photographic plates.—I. E.

The Varieties of Cultivated Pepper.—By C. A. Barber, M.A., Government Botanist, Madras; bulletin No. 56 of the Department of Agriculture, Madras. The pepper industry is of considerable importance in certain districts of Southern India, and this is an attempt to classify the different varieties of peppers cultivated. A number are described, and as a rule the names seem to be quite local. The infertility of certain cultivated pepper vines is remarked upon, and this has been looked into as it was thought there might be some purely botanical explanation. It is well known that pepper blossoms may be hermaphrodite or unisexual, and in this connection it is interesting to note that "One of the main results of the recent visit has been to shew that, even in the cultivated vines, while the ovaries are nearly universally present, stamens are by no means always to be found. Further, the fertility of a vine depends directly on the constancy with which the stamens are present. Any large absence of stamens will show itself in spikes with berries few and far between, fertilisation depending, as in the wild forms, on the chance presence of a neighbouring staminate vine flushing at the same time.

"Observations as to the means by which the pollen of the stamens is transferred from the pollen sacs of one spike to the stigmas of another are at present wanting. But from a general consideration of the fact that flushing takes place during the heavy driving rains of the monsoon, it is suggested that wind and rain are necessary, and that the splashing and falling of the drops dash the pollen over the whole plant. A moderate computation would put the number of flowers in a spike at between 75 and 100. This is the number of stigmas then In a fully hermaphrodite spike the number of pollen grains would be anything up to 30,000 or 40,000, and as one pollen grain is sufficient to fertilise one ovary, it would seem that an ample reserve is available for accidental dispersal.

"If this suggestion is correct, the effect of rain would be, first of all, to wet the dried up ground, and thus provide the material for the flushing of young leaves. Each new leaf is followed by a spike in the pepper at flowering time, the spike arising at the same joint as the leaf but on the opposite side. In the course of a few weeks the spike is seen to have elongated and to be covered with the little white star-like stigmas. These are very delicate and in the continued showers become covered with the wandering pollen from more advanced spikes. A further lengthening will then show the stigmas faded and the small pollen sacs peeping out on each side of the ovaries, ready to burst and scatter their pollen to other, later flowers. It would be interesting to observe if the spikes in the upper part of the vine mature first, for that would certainly aid in the fertilising of the flowers. It must be remembered however that, in the driving rain, pollen can be carried from one plant to another, this being regularly done in the wild vines of the forest, sometimes for considerable distances.

"According to this view of the fertilisation of the pepper flowers a long hot spell after the monsoon's commencement would cause stigmas to dry up before fertilisation could be effected and many spikes would drop, for any unfertilised flower is quickly thrown off by plants. The life of the male elements is short. On the other hand, a succession of short spells of rain and sunshine would be beneficial, since sunshine is necessary for the growth of the leaves and especially for the maturing of the fruits. Plants with too heavy topshade are poor bearers, and this is probably due to this absence of sunshine. Observations on all these points are much needed and can only be made by those living on the pepper plantations. The causes of the falling of the spikes especially should be studied. Both in coffee and cacao this undesirable feature is carefully watched for and its causes noted."

The pamphlet is illustrated with photos of the Balamcotta and Kallivall peppers of Wynaad, and a magnified drawing of a pepper flower showing the various parts and the difference between the hermaphrodite and staminate flowers.—I. E.

The Ceylon Board of Agriculture.

The Twenty-third Meeting of the Board of Agriculture was held in His Excellency the Governor's Pavilion on the grounds of the Ceylon Rubber Exhibition at Peradeniya, on Monday, 17th September, 1906, at 3 p.m.

His Excellency the Governor presided.

There were also present:—Hon. Mr. G. M. Fowler, Hon. Mr. J. P. Lewis, Dr. J. C. Willis, Messrs. W. D. Gibbon, Giles F. Walker, C. P. Hayley, R. Morison, A. T. Rettie, E. B. Denham, M. Kelway Bamber, T. Petch, T. J. Campbell, W. Dunuwille, G. W. Sturgess, Dr. H. M. Fernando, Messrs. E. E. Green, Daniel Joseph, Gerard Joseph, Charles Taldena, R.M., J. H. Meedeniya, R.M., and the Secretary.

The following were present as visitors:—Messrs. J. B. Carruthers, James Ryan, Hon. T. L. McClintock Bunbury, P.S., Col. H. Byrde, Messrs. Walter C. Price, H. Keyt, Tambopillai Mudaliyar (Maniagar of Jaffna), and C. Rasanayagam Mudaliyar.

Business Done.

1. The Minutes of the last meeting were read and confirmed.

2. On the motion of the Hon. Mr. J. P. Lewis, seconded by Mr. W. D. Gibbon, it was resolved:—That the Board desires to record its regret at the death of the late Mr. T. B. Rambukwelle Ratemahatmeya, who was a member of the Board, and to express its sympathy with the members of his family.

3. List of new members was read.

4. Progress Report No. XXII was tabled.

5. Reports of the Director and the Acting Curator, Royal Botanic Gardens, the Superintendent of School Gardens, and the Government Veterinary Surgeon on the sections judged by them at the Kurunegala Agri-Horticultural Show were tabled.

6. Statement of Revenue and Expenditure for the first half-year of 1906 was tabled.

7. A paper was read by Mr. E. B. Denham, C.C.S., late Secretary to the Board on "The Use and Objects of Agricultural Societies." On the suggestion of Mr. W. Dunuwille, His Excellency the Governor directed that the paper be translated into Sinhalese and Tamil for circulation.

8. Reports from the Curator, Royal Botanic Gardens, the Superintendent of School Gardens, and the Government Veterinary Surgeon on the sections judged by them at the Kelani Valley Agri-Horticultural Show were tabled.

9. In connection with the report on the proposed Ordinance dealing with Agricultural Pests, which was adopted at the last meeting of the Board, the Secretary submitted a further memorandum on the subject of the proposed Ordinance received from Sir William Twynam.

At the desire of His Excellency the Governor it was resolved that Sir William Twynam's remarks be referred to the Sub-Committee by whom the previous report was drafted, namely:—The Director, Royal Botanic Gardens, the Government Chemist, Hon. Mr. S. C. Obeyesekere, and the Hon. Mr. F. Beven—the names of the following gentlemen being added to the Sub-Committee :—Sir William Twynam, Mr. W. D. Gibbon, Mr. Giles F. Walker and Dr. H. M. Fernando.

The meeting terminated at 4-15 p.m.

Agricultural Society Progress Report. XXIII.

1. *Agricultural Shows.*—The *Kegalla* Agri-Horticultural Show was held on the 21st and 22nd September. I was present on the first day, when the Show was opened by the Government Agent, Sabaragamuwa, Mr. R. B. Hellings. Though it was not the first time that a Show of the kind had been held at Kegalla, none had been held for several years. But, through the untiring efforts of Mr. M. Stevenson, Assistant Government Agent and Chairman of the Local Agricultural Society, a widespread interest in the Show had been aroused throughout the District ; and not only were the exhibits excellent and varied, but the number of villagers attending the Show far exceeded anything that I have seen at any previous Show. The charge for entrance on each day was only ten cents. Books of entrance tickets had been distributed to every village headman throughout the district—tickets to be issued to all persons subscribing ten cents or over. In spite of the fact that a very large number of people had obtained tickets in this way, the stock of tickets for sale at the gate of the Show grounds was exhausted within an hour and a half of the opening of the Show. Mr. Stevenson and the members of the Kegalla Society are to be congratulated on having overcome a difficulty that almost invariably presents itself in connection with these Shows : that is, their liability to become rather a source of entertainment to the local residents of the towns in which they are held than a means of instruction to the villagers of outlying districts, whom it is more especially the object of this Society to reach.

Another feature of this Show was that, while the sheds containing exhibits of produce were surrounded by an enclosure, to which admission could be obtained only by ticket, the livestock sections were shown on an open space near the roadside, no entrance fee being charged to see them. There was also an extremely interesting collection of art work and curios in the Town Hall, while inside the main enclosure accommodation was provided for laceworkers, cloth weavers, &c. Each class of exhibits in the enclosure was shown in a separate shed—an arrangement which added greatly to the convenience of spectators, and one which might with advantage be adopted at other shows.

A point to which I should like to call the attention of all Agricultural Show Committees is the advisibility of making the passage-ways between the show counters considerably wider than is usually done. At all the Shows I have hitherto visited I have noticed that the narrowness of the passages has proved a source of inconvenience when the sheds are at all crowded.

The reports of the Government Veterinary Surgeon and the Curator, Royal Botanic Gardens, on the classes judged by them at the *Kegalla* Show are laid on the table.

2. A meeting of the Local Agricultural Society, *Nuwara Eliya*, has been fixed for Thursday, the 4th October, at 2 p.m., at the Nuwara Eliya Kachcheri, to discuss matters regarding the Agri-Horticultural Show to be held during Easter Week, 1907.

3. A show of fruits and vegetables grown in Weligam Korale will be held some time in October at *Telijjawila*.

4. The Market Show, under the auspices of the Three Korales and Lower Bulatgama Society, will be held at *Yatiyantota* on the 21st instant.

5. The Agri-Horticultural Show, under the auspices of the *Wellaboda Pattu* (*Galle*) Agricultural Society, will be held on the 16th and 17th November.

6. *Lemon Grass.*—The Model Farm, Colombo, has a supply of Lemon Grass rootlets for sale. Application for these should be made to the Government Veterinary Surgeon.

7. *Cotton.*—Eight bags of cotton seed have been supplied free of cost by Dr. H. M. Fernando for experimental cultivation on chenas in the Mullaittivu District.

8. *Foreign Vegetable Seeds.*—A supply of vegetable seeds will be imported shortly, and intending cultivators are requested to communicate with me as early as possible, stating their requirements. Orders will be attended to in the order in which they are received. The varieties available are as follows :—

French Dwarf Beans	Cucumber	Potseed
Beet	Egg plant	Pumpkin
Cabbage	Gourd	Radish
Capsicum	Knol-Khol	Spinach
Carrot	Lettuce	Tomato
Cauliflower	Melon	Turnip
Celery	Onion	Vegetable Marrow
Chilli	Parsnip	
Chinese Cabbage	Pea	

9. *Potatoes.*—The Welimada Branch Society proposed to experiment with Naples potatoes. This Branch is also experimenting with various kinds of native low-country vegetables.

10. *Vegetable Gardens.*—The Tangalla Local Branch, at its meeting held on the 8th September, adopted a resolution : "That a prize be offered for competition among the members of the Society for the best vegetable garden in West Giruwa Pattu, to be competed for in or about February, 1907—the prize to take the form of silver medal, price not to exceed Rs. 12·50."

11. *Seeds.*—The Branch agreed at the meeting held on the 8th to apply for different varieties of seeds from the Parent Society for distribution amongst the members on payment, the competition for the medal being confined to the produce of the seeds obtained from the Ceylon Agricultural Society only.

12. *Experimental Gardens.*—The Secretary of the *Telijjawila* Branch reports that the Village Committee have, with the approval of the Assistant Government Agent, voted Rs. 55 for making a *Fruit Garden* on the girls' school premises at Paraduwa, *Dampella*. The money voted will be spent in procuring a wire fence and the necessary labour. Fruit trees of different varieties will be supplied free of cost from the Royal Botanic Gardens for planting in November next.

13. *Publications.*—The Editors of the "Sihala Samaya" and the "Dinakara-prakasa" have kindly sent 50 copies of editions of each of their publications containing translations of the minutes of the last meeting of the Board. These copies, as usual, were distributed among the Local Branch Societies.

14. *Paddy: Kiushu.*—Mr. J. P. William, of Henaratgoda, writes that the Kiushu paddy sown by him did not germinate.

Mr. V. H. Vanderstraaten reports from Kurunegala:—"I sowed 26 measures of Kiushu paddy at the end of May last; although it germinated well, the growth was very stunted, and the outturn last week was only ¾ measure of paddy."

15. *Castration of Cattle.*—The Government Veterinary Surgeon reports as follows:—

To date the figures are 2,621 cattle castrated belonging to 2,122 owners at 124 demonstrations. 129 men have been taught the operation.

A. N. GALBRAITH,

1st October, 1906. *Secretary, Ceylon Agricultural Society.*

The Ceylon Board of Agriculture.

The Twenty-fourth Meeting of the Board of Agriculture was held in the Council Chamber on Monday, October 1st, 1906, at 12 noon.

His Excellency the Governor presided.

Others present were:—The Hon'ble Mr. G. M. Fowler, the Hon'ble Mr. Francis Beven, Messrs. E. E. Green, R. B. Strickland, Don Solomon Dias Bandaranayake (Maha Mudaliyar), Dr. H. M. Fernando, Messrs. E. B. Denham, G. A. Joseph, and the Secretary.

Mr. R. P. Jayawardene was present as a visitor.

BUSINESS DONE.

1. The Minutes of the last meeting were read and confirmed.
2. List of new members was read.
3. Progress Report No. XXIII was circulated.
4. Report of the Government Veterinary Surgeon on the Kegalle Agri-Horticultural Show was read.
5. A Paper was read by Mr. E. E. Green, Government Entomologist, on the work done at the Silk Experiment Farm at Peradeniya. A brief discussion followed, in which His Excellency the Governor, the Hon'ble Mr. Fowler and Mr. Strickland took part.
6. The Secretary announced that His Excellency the Governor had been pleased to nominate Mr. R. E. Paranagama, Ratemahatmeya of Pata Dumbara, as a member of the Board for the Central Province, in succession to the late Mr. T. B. Rambukwelle Ratemahatmeya.
7. On the motion of the Hon'ble Mr. F. Beven, seconded by Don Solomon Dias Bandaranayake, Maha Mudaliyar, it was resolved that the thanks of the Board be conveyed to the following gentlemen for the trouble taken by them in arranging for the various exhibits shown on behalf of the Agricultural Society at the Ceylon Rubber Exhibition:—

Dr. A. K. Coomaraswamy, for arranging the Arts and Crafts section.

Mr. M. Kelway Bamber, for exhibits of coconut products, camphor, and tobacco.

Mr. E. E. Green, for exhibit of sericulture.

Mr. C. Drieberg, for exhibit of oils, fibres, and tanning and dyeing stuffs.

Mr. A. E. Rajapakse, Muhandiram, for samples of cinnamon.

Mr. C. E. Barber, for exhibit of cocoa and chocolate.

Dr. H. M. Fernando and Mr. J. W. C. de Soysa for samples of cotton.

Mr. J. Whitehead for demonstration in cotton ginning and dyeing. Also the Government Agents, Jaffna and Batticaloa, and the following Local Agricultural Societies for a variety of interesting exhibits :—

Local Agricultural Societies of Telijjawila, Dumbara, Chilaw, Wellaboda Pattu (Galle), Kandaboda Pattu (Matara), Mannar, Vavuniya, Trincomalee, and Matara.

8. The Secretary submitted a fly-whisk made of reed-bamboo sent in by the Acting Director, Colombo Museum. His Excellency the Governor desired the Secretary to make enquiries with a view to ascertaining whether any market could be found for such an article.

The meeting terminated at 1-30 p.m.

Agricultural Society Progress Report. XXIV.

1. *Local Branches:—Dumbara Branch. Co-operative Credit Society.*—At a meeting of the Committee of the Co-operative Credit Society, Dumbara, held on 30th August, at Teldeniya, the Honorary Treasurer reported that Rs. 420 had been received from twenty-two subscribers. It was agreed to purchase only 50 bushels of paddy for the Madugoda store, and that the rest of the money in hand be deposited in the Ceylon Savings Bank.

Harispattu Branch.—At the Second General Meeting of this Branch held on the 28th October, it was decided that *experimental gardens* be opened in each Korale, situated either adjoining or near the chief school of the respective Korales. It was further decided to open a *seed store* at Katugastota.

The *judging of school vegetable gardens* competing for the President's prize of Rs. 10 has been fixed for the 18th November.

The following gentlemen among others have consented to become honorary members of the local society:—Messrs. Henry A. Barton, Gilbert James, W. H. Biddulph, and J. A. McAllister.

Wanni Hatpattu Branch.—At a meeting of this Branch held on the 17th September it was decided to encourage cultivation of cotton on Crown chena given on liberal terms by Government. It was resolved that all headmen open vegetable gardens so as to encourage villagers to do the same, who can obtain seed on application to the Chairman ; also to take active steps to enforce penning cattle—the first step towards introducing tobacco cultivation in the hatpattu—and that members of the Society and headmen open tobacco gardens in 1907.

Matale Branch.—On the 18th October I presided at a general meeting of the Matale Agricultural Society. The Honorary Secretary gave a short statement of work done since the last meeting, and mentioned that this Branch gained a gold medal offered by the Parent Society for exhibits sent in for the Imperial Institute. Reports were read from Chief Headmen reviewing their experience in experiments in vegetables, cotton, groundnuts, chilli, and six-months paddy growing. It was decided that steps should be taken for the establishment of an *Experimental Garden* in Matale town, and the Honorary Secretary was asked to try and make arrangements for a suitable site. It was agreed that the *Agri-Horticultural Show*, which was originally fixed for August last, but which had to be postponed on account of the drought, should be held next year, preferably in the early part of June. A paper was read by Mr. Tamby Rajah on " Pineapple cultivation."

2. *Agricultural Shows: Yatiyantota Market Show.*—I was present on the 21st October at the Yatiyantota Market Show, held under the auspices of the Three Korales and Lower Bulatgama Agricultural Society. The Show was opened by Mr. M. Stevenson, Assistant Government Agent, Kegalla. Mr. E. B. Denham, with whom the idea of holding a market show had originated, was also present. The date fixed for the Show was the ordinary market day, and the exhibits consisted of the fruits and vegetables ordinarily sold in the market. Money prizes, varying in value from Re. 1 to Rs. 10 had been subscribed by a number of planters and other gentlemen resident in the neighbourhood, as well as by headmen and members of the Local Society. All arrangements in connection with the Show were in the hands of Mr. J. H. Meedeniya, Ratemahatmeya; Mr. H. W. Boyagoda, Acting Ratemahatmeya; and Mr. J. A. Ratnayake, Honorary Secretary of the Local Society. This Show was the second of its kind, the first purely market show having been held at Minuwangoda on 7th April last. Its success proved that the presence of a band and the presentation of medals are not essential to the realization of the practical object of all such shows, namely, the encouragement of the spirit of competition and co-operation amongst the village cultivators. The display of vegetables in all classes was good, yams and chillies being especially well represented. The total cost of the Show was Rs. 462·37, Rs. 249 of which was distributed to the prize-winners.

Agricultural Fair, Telijjawila.—The Agricultural Show, which was to have been held at Teljjawila in the Weligam Korale of the Matara District on the 31st October, has been postponed owing to the inclemency of the weather. The Show, which will take the form of a Market Fair, will be held on the afternoon of the 15th November, commencing at 2 p.m., at the Telijjawila Experimental Garden.

The Wellaboda Pattu (Galle) Agri-Horticultural Show, under the auspices of the Local Branch Society, is fixed for the 16th and 17th instant. Paddy fields competing for the prize offered for the best field of transplanted paddy have been judged by the second Assistant Superintendent of School Gardens; and the Gardens will be judged probably this week by a member of the staff of the Superintendent of School Gardens.

3. *Citronella and Lemon Grass.*—The Controller, Experiment Station, Peradeniya, reports as follows:—"The plots at Sita Eliya and Hakgala have been inspected and the grass distilled. In the Hakgala plots the lemon grass and citronella shoots were planted on the 4th September, 1905, on very poor soil, under the shade of large trees. The yield of fresh grass and oil was very poor. In the Sita Eliya plots the grasses were planted in nursery beds, which had been previously manured. The citronella grass was planted in October, 1905, and cut on the 20th July, 1906. A yield of 155 lb. of fresh grass was obtained from the original twenty slips, and on distillation this yielded 8 ounces of pure oil of good quality. The lemon grass grew fairly satisfactorily, but, owing to the cut grass being forwarded to Colombo instead of being delivered to me, no distillation was carried out. I have recommended that a further trial of citronella and lemon grass be made on the patana near Sita Eliya, using the large stools now on the spot for planting purposes."

Lemon Grass.—Rootlets of this grass may be purchased from the Government Veterinary Surgeon, Colombo; Mr. B. Samaraweera of Weligama; and Mr. H, Napier Dias of Galle. These gentlemen report that they have respectively about 50,000, 500,000, and 800,000 rootlets available for sale.

4. *Foreign Vegetable Seeds.*—Applications are now being booked for supplies of vegetable seeds shortly expected from England. Intending cultivators are

requested to communicate with me as early as possible, stating their requirements The names of varieties available are as follows :—

French Dwarf Beans	Cucumber	Potseed
Beet	Egg plant	Pumpkin
Cabbage	Gourd	Radish
Capsicum	Knol-Khol	Spinach
Carrot	Lettuce	Tomato
Cauliflower	Melon	Turnip
Celery	Onion	Vegetable Marrow
Chilli	Parsnip	
Chinese Cabbage	Pea	

5. *A Simple Preventive against Malaria.*—I have received several requests for information as to the method of preparation of this preventive against malaria (given in leaflet No. XXVIII). The proportion of the various ingredients used in the preparation are quoted below for general information :—

1½ parts citronella oil.

1 part kerosine oil.

2 parts coconut oil.

1 to 2 per cent carbolic acid—that is, 1 to 2 per cent of the citronella, kerosine, and coconut oils.

6. *Cotton Cultivation.*—Twelve bushels of cotton seed have been supplied by Messrs. J. Whitehead & Co., Maradana, to Hulugalla Disawa for distribution among chena cultivators. Six bushels of Sea Island cotton seed were sent to Anuradhapura for similar cultivation.

7. *Tobacco Cultivation.*—The Badulla Branch intends experimenting with tobacco in the drier parts of Uva, and has applied for a supply of seed. The Wanni Hatpattu Branch have decided to cultivate tobacco during the yala harvest of 1907—in April and May next.

8. *Varieties of Indian Arecanuts.*—The Deputy Commissioner of Kadur District, in reply to inquiries made, reports that the following varieties of arecanuts are available in January next :—

White arecanuts : Mangalore, Cananore, Shrivardhan.

Red arecanuts : Naroikadi, Goa, Wesai (from Bassein), and Sewali.

Applications may be addressed to me to be included in the order to be forwarded in December. The price of 500 seed nuts of each variety is Rs. 2-8-0 in India.

9. *Paddy for the Imperial Institute.*—Mr. T. B. Pohath-Kehelpannala of Gampola has offered to send in a supply of "yava wi" to be forwarded to the Imperial Institute as an addition to the collection already sent there by the Society. This paddy is described as being efficacious in cases of consumption. It differs from other kinds of paddy in point of flavour and appearance.

10. *Seed Paddy from India.*—Supplies of six-and five-months seed paddy imported from India by the Society in August last are still available. The paddy consists of three varieties of samba, all white grain. Cost of the paddy is Rs. 2·75 per bushel.

11. *School Gardens.*—Rewards to school boys for good work in gardens on the same lines as last year will be given this year.

12. *Experimental Garden at Horetuduwa.*—On the land which Simon Fernando Sri Chandrasekere, Mudaliyar, proposes to hand over to Government—will be taken in hand shortly. The donor has already paid in the sum of Rs. 2,500 towards the maintenance fund of this institution, and the only delay is the completion of the necessary deeds, &c.

13. *Fodder for Cattle.*—The Secretary of the Mannar Agricultural Society has sent a supply of seed of the "umbrella" tree (*Accacia planifrons*) Tamil "udai," the leaves and fruit of which are recommended as an excellent fodder for cattle. This fodder is extensively used in the Mannar island. Seeds can be supplied to applicants, free of charge, on application to the Secretary, Ceylon Agricultural Society.

14. *Castration of Cattle.*—Demonstrations in castration of cattle were held in the Udukinda division of Uva in the following centres: Mahawala, Dehiwinne, Atampitiya, Welimada, Kitawera, and Kurakandura; 158 cattle belonging to 55 owners were operated on, and four men trained to do the operation.

The progress of work done by the Government Veterinary Surgeon's Department since the last report is as follows :—

North-Western Province	... ...	6 demonstrations
North-Central Province	... ...	2 demonstrations
Province of Uva	... ...	6 demonstrations (as above detailed)

The figures to date are : 2,868 cattle castrated, brought by 2,239 owners; 136 men have been trained at 138 demonstrations.

15. *Publications.*—Fifty copies of the "Sihala Samaya" have been kindly sent by the Editor, containing translations of the Minutes of the last Meeting of the Board. These copies, as usual, were distributed among the Local Branch Societies.

16. *Sericulture.*—The Superintendent, School Gardens, reports that between May, 1905, and September, 1906, eggs of eri silk worms have been supplied to 83 Government and Grant-in-aid schools in the Western, Central, Southern, North-Western, North-Central, Sabaragamuwa, and Uva Provinces, as well as to 150 individual school boys and 50 other private persons. The Government schools have in their turn supplied a large number of schools and villages in their neighbourhood.