THE

TROPICAL AGRICULTURIST

AND

MAGAZINE OF THE

CEYLON AGRICULTURAL SOCIETY.

VOL. XXXIII. COLOMBO, AUGUST 15TH, 1909. No. 2.

THE LORANTHUS PARASITE.

The genus Loranthus is represented by seventeen species in this country, seven of which are common upcountry, whilst eight of the species are endemic, or found only in Ceylon.

Loranthus belongs to the group of plants known as semi-parasites, that is to say, it possesses green leaves of its own, but is nevertheless dependent upon some other plant for a portion of its food supply. Its habit of growth is closely similar to that of its near relative the mistletoe.

The seeds, which are distributed by birds—and chiefly by the very small flower-pecker which rejoices in the name of Dicaeum erythrorhynchum—germinate upon the branch of some tree or shrub, particular host plants being affected to some extent by particular species of the Loranthus. Some of the species seem to be almost indiscriminate in their attentions, but a full study of the different hosts of the different species still remains to be made.

When the seedling germinates, instead of forming roots like those of an ordinary plant, it develops a special kind of suckers known as haustoria, which penetrate beneath the bark of the tree attacked by the parasite, and, ramifying chiefly between the bark and the wood, absorb a portion of the nutriment which the host had prepared for its own purposes. If a tree is badly attacked in this way the drain upon its resources may be so great that it may become seriously crippled or even eventually killed.

Some prominence has recently been given in the local Press to accounts of the appearance of this parasite upon tea at Nuwara Eliya. We may state at once that we consider anything in the nature of a scare on this account to be entirely devoid of justification. It has been known for a considerable number of years that more than one species of Loranthus will attack tea if this crop is neglected, or allowed to run for long periods without pruning. As might be expected, it is especially common to find the parasite upon tea plants which have been allowed to grow up as seed-bearers. It is generally thought that, with a moderate amount of care, healthy tea bushes can be kept entirely free of the Loranthus parasite.

It so happens that some of the commonest of the species of Loranthus which are known to attack tea also affect the species of Acacia which are commonly planted amongst, or in the neighbourhood of, tea at high levels. It is therefore desirable that a watch should be kept upon these as well as upon the tea itself, and that any plants

observed should be removed before they have time to flower. The same species are also abundant upon jungle trees in the neighbourhood of tea clearings and elsewhere, and for this reason anything like the total extermination of the pest is undoubtedly quite out of the question. It may perhaps be worth while to remove Loranthus plants from the fringes of the jungle bordering upon a tea estate, since the seeds are more likely to get carried on to the tea from such a position.

Loranthus is not a plant which is likely to develop into a rapidly spreading pest after the fashion of some fungus diseases. Its rate of reproduction is so comparatively slow and the plant itself is so comparatively conspicuous that, with a little trouble, it could readily be kept in check upon such a closely cultivated crop as tea, even if the parasite were to become very much more persistent in its attacks than is the case at present. Nor is Loranthus likely to spread in any abundance over large distances, since it is dependent upon one or two species of birds for its distribution, and therefore unlike a fungus, the spores of which may be carried to indefinite distances by wind.

As regards the method of dealing with Loranthus as a pest there is only one remedy, and that is the knife. Whenever the plant is seen upon a tea bush or upon any other plant, the life of which is valued, the parasite should be immediately cut out together with a considerable portion of the branch which bears it. The haustoria of the parasite may travel down to quite a considerable distance below the point at which the leafy shoot emerges, and if any of this rooting portion is left within the branch, the part remaining will be capable of giving rise to fresh shoots of the Loranthus. By close inspection of the section of a branch it can generally be ascertained whether the parasite has been completely removed or not. It is also advisable to remove the Loranthus as far as possible from other trees in accessible places near estates, and badly affected trees may be cut down.

We take this opportunity of drawing attention to some extracts made by Mr. Petch from a paper published by Professor Keeble in the Transactions of the Linnæan Society as the result of observations made during a visit to Ceylon. These extracts deal chiefly with the fertilization of the flowers of Loranthus and with the distribution of its seeds by birds. These extracts appear on a later page of the present issue of the *Tropical Agriculturist*.

R. H. L.

Reviews.

THUMB-NAIL PRUNING AND DISEASE.

[Note sur la ramification de l'Hevea par la taille et par l'effeuillage par M. A. de Ryckman. *Journal d'Agriculture Tropicale*, No. 91, Jan. 1909, pp. 5-7.]

"The development of the branches of young heveas is always a subject of engrossing interest to planters. There has been much discussion on this point, but no completely satisfactory solution has been reached. The natural tendency shown by young heveas to produce a tall stem certainly retards their growth in diameter, and consequently in tappable area. It does sometimes happen that a slender tree gives a greater yield of rubber than one with a short thick main stem, but that is not the general rule.

"H. Wright has advised pollarding the stem at a height of about twelve feet. In this way, an excellent length of trunk for future tapping, and a much more rapid growth in thickness are effectively produced; but the practice appears to be attended by some disadvantages.

"After the pollarding, a crown of young branches appears below the wound, forming a head like that of a pollard willow at a single point of the stem. Two only of these shoots are preserved in order to form the fork of the tree; the suppression of the others naturally causes numerous wounds which, if they are not immediately covered with some preservative, afford as many points of attack for insects or fungus spores. The first pruning must generally be followed by a second, sometimes even by a third, whence occur fresh wounds as dangerous as the first.

"In support of his theory, H. Wright correctly observes that the foliage, thus increased, exerts a favourable influence on the growth of the trunk. But may not the following consideration be set against this; is a very young tree capable of supporting without injury an abnormal augmentation of its foliage? Indeed, though the leaf is the organ in which the sap is elaborated, it is also the chief organ of evaporation; from which it follows that in multiplying the number of leaves, the evaporation (transpiration) is increased tenfold. Hence it may happen that the equilibrium between the root system and the foliage may be disturbed, and that the tree may hereby acquire a more marked predisposition to disease, in spite of its apparent vigour. This is only a personal hypothesis deduced from my observa-

tions in Java and Sumatra, where fungus diseases, of which the most frequent is caused by *Corticium javanicum*, Zimm. (called in Malay "Djamoer Oepas"), attack principally those trees on which the desired branching has been produced naturally, and those on which it has been induced by human agency.

"This terrible disease, which Dr. Bernard has written about, seems in fact to originate, for preference, in the axils of branches where rainwater lodges, and to spread afterwards in all directions. Under the shade of a crowded plantation where the air is constantly humid, fungi develop with extreme ease. It is certain that their spores, falling in a favourable situation, on a wound incompletely healed, grow very rapidly, and cause immediate injury to the trees.

"If these observations are correct, the branching of the stem ought to be induced with as little pruning as possible. With this object, I have cut off all the leaves of several young heveas, about fifteen months old and four metres high, leaving only the buds arising from the terminal crown, thus giving the tree the appearance of a long switch. At the end of a month young shoots appeared in the axils of the old leaves. These shoots, the future branches of the tree, have the advantage of being arranged at irregular distances sufficiently far apart.

"The terminal crown, alone, produces too many branches, and some of them must be suppressed; but at this stage the tissues are so young that cicatrisation is very rapid, and does not permit the development of the terrible *Corticium*, which appears rather on stems with wood already formed or in course of formation.

"Among the trees experimented upon, some which possessed leaves scattered along the whole length of the stem instead of being grouped in false whorls were intentionally chosen; for trees of this type, which expand with the greatest readiness, removal of the leaves appears very suitable. The result sought by Mr. Wright, *i.e.*, the increase of the circumference of the stem in consequence of the increase of the foliage, is here equally attained while a presumed source of danger is avoided.

"Personally, I do not believe that there is any great advantage in inducing branching before the end of the second year. At that time, the majority of heveas branch of their own accord, and it would be sufficient then to induce it in those which proved refractory. Finally, up to the present it is scarcely decided that, as a producer of rubber, a dwarfed tree has any real advantage over one which has not been dwarfed (rabattu).

"*P.S.*—In addition to these interesting observations, M. de Ryckman has forwarded an excellent photograph of a plot of heveas which have been treated by defoliation; these young trees are perfectly shaped, and their branching is not less symmetrical than that of trees in Ceylon, made to branch by pollarding, of which we have been permitted to see photographs.—Editor, *Journal d'Agric. Tropicale.*"

To the above may be added the following extract from the Continuation Report on the Kambe Rubber Plantation, Rangoon, by Lt.-Colonel J. A. Wyllie:—

"As the young trees come on, they will require pruning to encourage development of the crown and stem, and to check too rapid upward growth. This can best be carried out by simply nipping off the terminal bud when the tree has attained a height of anything from six to fifteen feet. A tree of fifteen feet that has not been pruned is, as a rule, sufficiently flexible to allow of its being bent down within reach of the operator. This is what is known as thumb-nail pruning, but may of course be done with a knife or a pair of scissors if preferred. The operation may subsequently be extended to the top lateral shoots, and a bushy growth of the whole crown produced. Some trees have a habit of sending out lateral shoots all down the stem, which should be discouraged severely by means of pruning. The best type of tree for practical purposes is one forking about five feet (*sic*) from its base, as the tapping area is thus likely to be larger than in the case of a single stemmed tree."

Evidently the idea of thumb-nail pruning has been regarded more seriously in other countries than in Ceylon. It would be interesting to know whether any large areas have been treated in this fashion in Ceylon, and where the photographs alluded to were taken. It is certainly not a common practice, as the authors quoted appear to think. The objection taken by M. Ryckman—that parasitic fungi readily develop in the forks of trees because of the flow of rainwater over them, and the consequent disintegation of the bark,—was privately urged in 1906, but, in the absence of any enthusiastic adoption of the proposed system, it was not considered worth while to press the matter further. *Corticium javanicum* is fairly common in Ceylon, but its effect is not so terrible as it appears to be in Java

It occurs at Nuwara Eliya on Plum trees, and in the Southern Province on Orange trees—in both cases gradually killing back the branches. In the wetter upcountry districts it sometimes appears on tea towards the end of the south-west monsoon, and then causes "branch canker." Instances of its occurrence on Hevea have been recorded from most of the rubber districts. On Hevea it usually begins in the fork of a tree which divides at a short distance from the ground, or where two or three branches spring in a whorl from the main stem. The fungus spreads over the bark in a thin pink sheet, and, when this sheet dries, it splits into patches which are supposed to resemble hieroglyphics; for this reason it is known in the F. M. S. as the writing fungus. It lives entirely on the bark, gradually killing it and ringing the tree. Probably the dry periods in Ceylon prevent its spreading to such an extent as in Java. In South India, however, it does considerable damage, attacking the main stems of young trees and killing them out completely if they are not "stumped." It is hoped to issue a circular on this subject shortly.

It may be pointed out that this fungus and a common root disease provide the chief objections to interplanting rubber and cacao. An undergrowth of cacao ensures a humid atmosphere which favours the growth of parasitic fungi on the stems of the Hevea.

T. PETCH.

GUMS, RESINS, SAPS AND EXUDATIONS.

RUBBER IN SOUTH INDIA.

(From the *Indian Agriculturist*, Vol. XXXIV., No. 4, April, 1909.)

The *Madras Mail* calls attention to the further light thrown on the prospects of the rubber industry in Southern India by the publication of the Reports and the proceedings of the General Meetings of a number of rubber-growing Companies, with land in the Native States of Travancore and Cochin and in the Madras Presidency. A perusal of the details given leads one to the conclusion that Mr. Proudlock in his Report on Rubber in Malabar was correct in his belief as to the exceeding suitability of the coastal country which lies between the sea and the foot of the Western Ghauts, both as regards climate and soil, for rubber cultivation on an extensive scale. The Periyar Rubber Company is perhaps the most interesting concern at present in Southern India, because tapping operations have already commenced there in earnest. Of the 867 acres planted with rubber 238 were planted in 1902, and from this area 11,340 lb. of rubber were harvested last year. Details are given in the Report which afford an idea of the profit to be derived in these days from rubber trees which have reached the tapping stage, the generally accepted standard for which is a girth of 18 in. at 3 ft. from the ground. For instance, the cost of production after debiting a fair proportion of standing charges and irrecoverable coast advances to working account was Rs. 14,038·08 or only Re. 1·12 per lb., while the average price realised for the rubber was R. 3·23 per lb. The estimate for this year is 32,500 lb. of rubber from 29,984 trees, and it is expected that this will be obtained at a still lower cost, *i.e.*, after including a fair proportion of the standing charges, at 93 cents per lb. It is also to be noted that clean weeding is favoured by the management of this estate; that porcupines did so much damage to the clearing made in 1903 that it had practically to be replanted in the following year; that it has been decided to adopt the tapping process newly introduced in Ceylon; and that in the opinion of Mr. J. A. Hunter, a Ceylon expert who visited the property recently, there is no doubt about the quality of the soil and its suitability to the growth of Para rubber. The possibilities of this Company, the offices of which are in Colombo, will be admitted to be considerable when it is remembered that many authorities believe that an acre of ten-year-old rubber will annually yield 300 lb. of dry rubber; and it is in consequence scarcely surprising that the 4,000 shares of Rs. 100 of which its capital consists stand at a premium of over 100 per cent.

Another well-known Travancore rubber estate belongs to the Rani-Rubber Company, Limited. At its General Meeting, held recently in Colombo, the Chairman, Mr. J. G. Wardrop, said that the Company had now 2,875 trees 18 in. or more in girth 3 ft. from the ground, and

that as a result of a little experimental tapping work carried out towards the end of last year 67½ lb. of rubber of good quality had been harvested. He also said that he expected to undertake a considerable amount of tapping in the latter half of this year and to secure quite a large crop in 1910; and to make provision for this it has been decided to build a permanent factory and equip it with the best machinery, at a cost of Rs. 25,000. Out of a total area of 1,907 acres this concern has 1,296 acres planted with rubber, its paid-up capital amounts to Rs. 4 lakhs, and its Rs. 100 shares are quoted at a premium of nearly 100 per cent. The Annual Meetings of two other Travancore Rubber Companies were held in Colombo on the same day as that of the latter concern, *viz.*, the Perinaad Valley and the Shaliacary Rubber Companies. The oldest rubber on the estates of the former consists of 333 acres planted in 1906, and it is expected to get some return from this in 1911. A further 415 acres were cleared and planted in 1907, bringing the total area planted with rubber trees to 748 acres. The growth of the rubber is described as being good, except on some exposed faces which suffered from wind. The paid-up capital of this Company amounts to Rs. 2,10,000, its shares being quoted at about par. At the Shaliacary Company's Meeting the Chairman, Mr. W. Shakespeare, stated that the growth of rubber on some fields had been retarded by the spread of *illuk* or *lalang* grass, but that it had been satisfactorily checked by hand-weeding and by planting a variety of passion flower which covers the ground so completely as to choke the grass. The Directors have decided to manure the property, but it is not stated what is to be applied. The Chairman said in the course of his speech that 54 lb. of Para and 19 lb. of Castilloa had been sold last year. The 54 lb. of Para were secured from six 12-year old trees each of which averaged 9 lb. of dry rubber. Again, at the Meeting of the Travancore Tea Estates Company, Limited, held in London on the 11th March, Mr. D. G. A. Reid, who visited that Company's Estates last December, told his audience that they "had a number of Para trees, eight years old and upwards, which have been planted along the roadways and the yield per tree on experiment was so satisfactory that it was considered advisable to clear and open up more land two years ago for the cultivation of rubber."

Yet another South Indian rubber concern which held its Annual Meeting recently in Colombo is the Cochin Rubber Company, Limited. On this estate, the Chairman, Mr. P. Bois, said that weeding had proved rather more expensive than had been anticipated. Some experiments were tried with mulching plants, "but our Visiting Agent prefers dadaps (*Erythrina lithosperma*) to anything else, and we have large nurseries of these plants ready for May-June planting. Fork-digging has given excellent results. In the 1906 clearing six trees were measured at 3 ft. from the ground in December, 1907, and showed a girth of 4¾ inches. This had increased to 8½ inches in December, 1908. The trees in this clearing have branched well, and a great increase in the girth of the trees is expected this year." This Company owns 800 acres under rubber, half of it having been planted in 1900 and the remainder in the two following years. Its paid-up capital amounts to Rs. 1,92,000, and its Rs. 15 shares (Rs. 14 paid) are quoted at par.

Lastly, we have received the Annual Reports of two rubber concerns which have their headquarters in Madras, *viz.*, the South India Rubber Company and the Thodupuzha Rubber Company, the Secretaries of each of which are Messrs. Huson and Robinson. The former Company is growing Para rubber trees at a higher elevation than is generally considered most suitable and has interplanted them with coffee, and it has 990 acres devoted to these two products and to Ceara rubber. The growth of the rubber is reported to be regular, and the coffee, from which a crop of 7 tons is expected this year, is said to be coming on well, while 500 acres have been reserved for cardamoms. This policy of not putting all one's eggs into one basket has much to recommend it. The authorised capital of the Company is Rs. 3 lakhs, divided into 3,000 shares of Rs. 100 each, of which number 2,292 were allotted when the Company was formed, and the balance, 708, reserved for future issue. The Thodupuzha Company, whose lands are in Cochin, planted 550 acres with Para rubber plants, 18 ft. apart, last year, and the tapping stage is expected to be reached in 1913, while the question of interplanting with pepper is receiving consideration. The authosised capital of the Company is Rs. 3 lakhs, divided into 3,000 shares of Rs. 100, and 2,250 have been or are being issued.

The above are some of the principal Companies growing rubber in Southern India, and there are besides a number of rubber estates in private hands or being worked by Syndicates. The industry has advanced well beyond the experimental stage, and, as far as can be seen

at present, it seems destined to have a brilliant future, especially in those fortunate districts where labour is cheap and plentiful; and it must not be forgotten that, if present estimates prove correct and present prices continue, each acre of ten-year-old rubber is capable of yielding a profit of £50 per acre. Such prospects are but rarely held out by agriculture in any form, either in tropical or temperate zones; and though few planters in South India are sanguine enough to expect quite such handsome returns as that, they can, in our opinion, contemplate a fall in prices with less concern than their *confrères* in any other part of the world.

INDIA RUBBER AND ITS MANUFACTURE.

WITH CHAPTERS ON GUTTA-PERCHA AND BALATA.

BY HUBERT L. TERRY.

(From the Review in *Science*, December, 1908.)

One may fairly say that, next to mining, the growing of rubber has of recent years been increasingly regarded as a golden path to material ease. In common with mining, the project has its risks and drawbacks, and the only safe guide to intelligent investment in both is knowledge. This the general public does not have, but many individuals desire specific information, either for the reason observed, or for the sake of general enlightenment. With regard to rubber and its manufacture, Terry's book fairly meets this need; it is for such that it has been written. Though dealing with a distinctly technical field, the author has succeeded in making a very readable book, and this is due not a little to his pleasing style, occasional prolixity to the contrary notwithstanding.

One experiences a slight feeling of disappointment in reading the first two chapters, those dealing with the history of the matter and with the botanical origin of crude rubber. It would have been justifiable to have dealt with these topics with greater liberality, and the addition of treatment of greater length of the cultural aspects of the industry would have heightened the value of the book in a marked degree. It seems to the reviewer a fair criticism that the chapter on India-rubber Plantations is a trifle pessimistic. Mr. Terry's attitude is safe, because negative. A more just statement of the legitimate attempts which are being made in Mexico to cultivate rubber trees (*Castilloa*) would have had greater merit. Sharp practices do great damage to infant industries. So much more therefore do these demand proper representation at the hands of the critic.

To be commended in this connection is the effort to point out the need for adequate conservation of the natural forests of rubber-producing trees, a problem to which our modern forestry methods have not yet reached. Science will be needed in meeting this aspect of the industry quite as much as any other. Already her face has been turned toward plantation culture, with no little success, but the inevitable struggle of man with nature has already discovered a quite handsome array of parasitic enemies, whose energies appear to be largely concentrated upon cultivated rubber trees.

PLANTATION RUBBER YIELDS.

(From the *India Rubber World*, January, 1909.)

The latest mail advices to hand at this writing report the shipment from Ceylon and Malaya, during something less than eleven months of this year, of 3,401,734 pounds of plantation rubber. The figure for the corresponding period of 1907 was 1,935,103 pounds, and for the preceding year 908,965 pounds. Five years ago the amount was almost *nil*. The rapid growth in the volume of shipments evidently is due (1) to the increasing number of tappable trees, and (2) to an increased annual yield from those trees which have now been tapped for three or four seasons. It seems worth while to emphasize, in this connection, that in the mass of information that has come from the *Hevea* planting region of the Far East—reports so detailed as almost to suggest that every individual rubber tree has been scrutinized—no hint has appeared that one tree on suitable soil has failed to yield some rubber, or that any tree, once tapped, has failed to yield at subsequent tappings.

Thus far it has not been possible, however, to fix upon a definite minimum yield to be expected reasonably from a cultivated rubber tree, of any given age or size. But this is hardly essential. Is there a fixed law of yield of tea or coffee plantations, or of wheat or corn, or of grapes or pears? It is enough if, generally, the product per acre, or for a whole estate, affords a profit. The figures given above show that cultivated trees do yield rubber, and details constantly coming forward indicate an aver-

age production of 2 or 3 pounds per tree over considerable areas, taking young and old trees together. In addition to the data on this subject on another page of this issue, it may be noted that Mr. J. B. Carruthers estimates that *all* the rubber trees tapped in Malaya in 1907 yielded an average of 1 pound 12 ounces. The trees included in Perak alone yielded 2 pounds 1 ounce, and those in Negri Sembilan 2 pounds 7 ounces. These are not exceptional yields, but the figures relate to upwards of 1,300,000 trees.

We might pause here to consider the ultimate rubber production of Malaya, where, according to Mr. Carruthers' figures, the rubber planted to date—nearly all within three years—covers about 280 square miles of territory. In this great forest formed by the hand of man it is estimated that there are 97,558,440 rubber trees, planted generally at what is intended to be permanent distances apart. If all these eventually should give a yearly average of 2 pounds, the result would vastly exceed the world's present total production of rubber. In none of these estimates, by the way, is any account taken of Ceylon or the Dutch Indies, or of any part of America or Africa where rubber has been planted.

But our interest at this time is confined to the present yield of plantation rubber, and it appears abundantly established that the yield is ample for present profits on a scale beyond what is usual in most branches of agriculture. We must not leave the subject, however, without pointing out that all the figures used in this connection bear solely upon the cultivation of one rubber species—*Hevea*—in one part of the world. The study of other species, and under other conditions, remains to be carried to a practical conclusion.

CEARA RUBBER (*MANIHOT GLAZIOVII*).

BY H. POWELL.

(From the *Agricultural Journal*, British East Africa, I. 3, April, 1, 1908.)

Ceara or scrap rubber of commerce is produced by a small tree growing to a height of about 30 to 35 feet and attaining a stem, when fully developed, of a foot or more in diameter. The tree belongs to the natural order Euphorbiaceæ, and its natural habitat is said to be the Province of Rio Janerio, though it is now common in many tropical countries.

Well-grown trees are established at Mombasa and Rabai, and cultivation of Ceara rubber has during the past year or two been taken up on a commercial scale at Voi and Kibwezi. In the country around Malindi, also at Meritini and higher up the railway in the Mazeras district fairly large numbers of Ceara seedlings have recently been planted, and a much larger increase in this direction is anticipated during 1908, the demand for Ceara seed through the Agricultural Department being considerable.

A large plot of Ceara rubber trees at Meritini Experiment Station, Rabai district, is in vigorous health, the most advanced trees—about 20 months old—having already yielded good samples of rubber.

Several acres are being established at the Mazeras farm where the soil and general climatic conditions are seemingly eminently adapted for Ceara; the conditions existing at this place are typical of much of the surrounding country.

So far as can be ascertained the first Ceara trees in British East Africa were planted at the Mission Station, Rabai, whence the trees in the grounds of Mombasa Club were obtained by Mr. D. J. Wilson about nine years ago.

In 1883 Ceara rubber plants were introduced to Zanzibar from the Royal Gardens, Kew, and about 1892 or 1893 Baron Von St. Paul Ilaira obtained seed from another source and raised plants at Tanga, which were given by him to Mr. Koehler of Lewa in the Pangani district, and from these the extensive Ceara rubber industry in German East Africa has been mostly established.

The seed now being imported into British East Africa is from the Tanga district.

PROPAGATION.—This is usually effected by seeds which should be at least a year old from the time they fall from trees, and the latter should be from 3 to 4 years old, as seed collected from young trees do not produce such vigorous plants as from those of the age given.

If fresh seed is planted, *i.e.*, seed newly collected, germination is very slow, if at all, whereas seed one or two years old germinate readily and well and give good results.

SOAKING THE SEED.—Some growers place the seed in water for varying lengths of time, and others pour boiling water over the seed with a view to softening the shell or seed coat. In connection with this subject Mr. Gustav Eismann of Hale, Niussi, near Tanga, carried out a series of experiments by soaking the seed in water from a few hours up to a

month.and then planting these side by side with unsoaked seed, when results were found to be same. As stated before, the great point is to use seed at least a year old from strong healthy trees of about 3 to 4 years' maturity.

Selection of seed from the best rubber-producing trees is receiving the attention of experienced growers, by whom it is expected increased yields of rubber will result therefrom.

As a rule, the seed is sown in nursery beds, and when a few inches or a foot or more high, the plants are transferred to their permanent places in the fields. Some transfer the tiny seedling from the nursery beds or seed boxes into pots made of banana leaf sheaths or bamboo stems before final planting out.

The method of planting the seed in the field, or as it is known at "stake" is also practised by some, but by others condemned on the ground that many vacancies occur and the trees are of uneven growth in addition to more work being entailed in keeping the fields free of weeds during the first six months or so.

CUTTINGS.—Propagation is also carried out by sections of the branches an inch or more in diameter and a foot or upwards in length. These grow readily, but the trees readily assume a dwarf straggling habit and give off several stems which, if not early removed, retard the development of the tree. The rubber obtained from trees raised by seeds or cuttings is said to be of the same quality, and as regards yield no records are available.

SOIL, &c.—The tree thrives best in a good friable loamy soil of fair depth, and where the temperature and humidity are high, such as at many parts of the coast and other similar districts, but the elevation must not exceed about 3,000 feet. The tree thrives at higher altitudes, but the rubber has been proved to contain too much resin to be of sufficient commercial value.

PREPARATION OF LAND.—Should the land contain scrub this must be cut down and burnt or placed in rows to rot. In the same manner it will be found beneficial to clear away grass and weeds which may also be burnt when dry or allowed to decay to provide humus. If the land has not been under previous cultivation it would be much improved by ploughing or hoeing, but if hoeing is intended the land need not be turned over as subsequent weedings would stir up the soil.

LINING AND HOLING—In the matter of distances to plant opinions and practices differ very considerably, but for general purposes 12×12 is recommended. A favourite method by many is to allow 12 feet between the rows and 6 feet from plant to plant, and to tap each alternate tree in the rows to exhaustion after a year or 18 months' growth, the permanent distances being then 12′×12′. Six feet square is also allowed, and each alternate tree tapped to exhaustion. Others again allow about 9 feet permanently each way, but this distance is thought by most Ceara rubber planters to be too close.

The digging of holes 18″ in diameter and the same in depth is very desirable especially in new land where the soil is usually of a somewhat sour nature and needs exposure to the atmosphere. It is also advisable to allow the holes to remain open for a week or two before being fillled in with good surface soil. In the event of planting at stake being adopted holes should be prepared or a thorough stirring up of the soil carried out so as to give the seedlings a fair chance. From 5 to 7 seeds are placed at each stake, and should two or more seeds germinate, the strongest plant only is allowed to remain.

PLANTING.—This can best be carried out at the commencement of the long or short rains.

WEEDING.—As in the case of other cultivations the trees will be much benefitted by keeping the land free of weeds, for which three or four annual weedings will be ample.

PRUNING.—Some experienced growers remove the terminal bud or growing point when the plant is about 2 feet high. This is done to cause the lower part of the stem to thicken as it has been found that more rubber is obtained by tapping the lower part of the trunk than higher up. One trunk only should be allowed, and any branches appearing thereon should be early removed but no further pruning is necessary. The more numerous the terminal branches the more vigorous the tree becomes as the number of leaves is increased which are the lungs of the tree.

AGE AT WHICH TREE SHOULD BE TAPPED.—Practical experiments carried out over a series of years are said to have proved that tapping should be commenced at the end of the 2nd year, or shortly afterwards, as it has been found that trees that have remained untapped till the 4th or 5th year yield less rubber and of poorer quality than do such trees of a similar age, but which have been tapped early, say at the end of the 2nd year, and regularly afterwards; in fact, early tapped trees are found to yield rubber in increasing quan-

tity and are said to be like cows that are regularly milked. Of course, judgment must be used not to tap the trees to exhaustion, by which is meant tapping the whole area of the trunk at one time and often. By tapping only a small area of the trunk at one time a fresh section of strip can be treated about every fourth or sixth day, or in all about twenty-four times yearly, leaving out the very dry months, the already tapped surfaces being gone over several times during the year.

Tapping.—Formerly the mode of collecting Ceara rubber was as follows:—The loose stones and dirt around the base of the tree were removed by means of a bundle of twigs and large leaves were laid down. The collector then sliced off the outer layer of bark to a height of 4 or 5 feet and the milk exuded by many tortuous courses, a good portion of which fell to the ground. When thoroughly dry the rubber was either rolled into the balls or put into bags in loose masses in which form it entered the market under the name of Ceara Scrap. This method was very wasteful, and for want of a satisfactory system of collecting large areas of Ceara trees had been abandoned in various countries. To Mr. Koehler of Lewa, Pangani district, is given the credit of devising a method of collecting Ceara rubber which has resulted in establishing a successful and extensive industry in German East Africa. The system referred to which is known as the "Lewa" method may be described as follows:—About a quarter more or less of the surface of a tree is freely coated with the juice of a Citrus fruit such as sour orange, lemon or lime (to about the height of the tree), the citrus fruit being roughly peeled and cut in two. The bark is then horizontally stabbed with the point of a knife having a sharp thin edge, at distances of about 3 inches apart. The milk immediately exudes from the numerous small incisions, and at once coagulates on the tree from which it is easily collected about three-quarter of an hour to an hour afterwards, and made into the balls. Sweet oranges may be used, but as the labourers are apt to eat them sour ones are more suitable. Vinegar and weak carbolic acid have been proved to be suitable for coagulating the rubber. Even in a weak state, however, carbolic acid is found to injure the labourer's hands, consequently this is not in favour, even though the acid be applied with a brush. The juice from the sisal plant has also proved fairly successful in the matter of causing coagulation. If no acid be applied, it will be found that much of the milk is lost on the ground. Of the various knives tried, that known as a "Bookbinder's" knife has given the most general satisfaction in German East Africa. A chisel-edged knife is to be avoided, as the bark is injured thereby and does not readily heal up.

The authorities at Amani have found that the latex-ducts of the Ceara tree run principally perpendicularly, hence the need for making the incisions horizontally. About thirty average-sized sour oranges or lemons are said to be sufficient to coagulate a pound of Rubber.

Other methods of tapping are being experimented with in German East Africa, but for utility and simplicity the "Lewa" method has so far proved the most satisfactory and is readily understood by the labourers. The matter of obtaining a sufficient supply of citrus fruits is, however, of great importance.

A good man can easily collect 1 lb. or more of rubber per day, but a general average would be about ½ a lb. to ¾ lb. per labourer daily.

The early morning is the best time to collect the rubber, which, after being made into a ball, can be placed in papaw or banana leaves for conveyance to the store, where it is washed and squeezed in clean water to remove as much as possible of the impurities. It is then placed in an airy position to dry out of the direct rays of the sun, and when practically all moisture has been expelled it is ready for shipment.

Where proper machinery is available, the raw rubber is subjected to a washing, rolling and drying process, with the result that all impurities are quickly removed and the rubber rendered ready for shipment in a short time.

A ball of freshly collected Ceara rubber weighing 305 grammes was seen subjected to the washing, rolling and drying process referred to, at Amani, and finally weighed 144 grammes.

Yield of Trees.—These vary considerably, though the following figures supplied by an extensive grower in German East Africa may prove of interest:—

2nd to 3rd year	...	⅛ lb.
3rd to 4th year	...	¼ ,,
4th to 5th year	...	½ ,,
5th to 6th year	...	¾ to 1 lb.

Taking one tree with another a good yield of rubber per tree in full yield per annum would be from ¾ to 1 lb., though individual trees frequently very largely exceed this quantity, instance—On the Lewa estate there are several Ceara rubber trees from 9 to 10 years old which have produced from 10 to 14 lbs., German, each per annum. Again, six

trees about 5 years old on the Frederick Hoffmann Plantations yielded 3 lbs. of rubber each during the year.

As a rule trees of 10 years old are said to cease to yield rubber in paying quantities.

VALUE OF CEARA RUBBER.—For ordinary collected Ceara rubber the present price in Hamburg is from 3*s.* to 3*s.* 6*d.* per lb., but for machine-cleaned rubber a much higher price is obtained.

COST OF CULTIVATION.—As in the other cultivations the cost varies according to the nature of the land, rate of wages, &c., but the maximum cost is given as Rs. 85 per acre up to the end of the 2nd year.

At the lowest computation the rubber obtained from the trees at the end of the 2nd year, after paying cost of collection, would more than balance the expenditure on cultivation, and by the 3rd or 4th year a profit of from £10 to £15 per acre could be reasonably expected.

PRODUCTION.—Authorities agree that there is no danger of over-production of rubber for many years to come, as the demand for rubber is continually increasing. It is also admitted that the natural sources of supply are being gradually exhausted, and that in the future "Plantation" rubber will be more than ever sought after.

OIL FROM THE SEED OF THE CEARA RUBBER TREE.

In a recent Bulletin of the Imperial Institute mention is made that seeds of Ceara rubber had been examined in the Scientific-Technical Department, and that somewhat similar fixed oil to that yielded by Para rubber seeds was obtained. The oil is described as a greenish-yellow colour with an odour resembling that of olive oil and a somewhat harsh and bitter taste. The value of the Ceara oil is not given.

LABOUR,—In this matter a serious difficulty presents itself. as the native shows a distinct aversion to take up regular employment, if indeed any at all, and without a regular supply of labourers rubber cultivation cannot be profitably carried on. For each acre of trees at least five labourers will be needed for collecting the rubber, and it is found more satisfactory to pay by results.

The *India Rubber Journal* of April 9th, 1906, has the following :—

"NEGLECTED CEARA."

Many Ceylon planters are now wishing they had not been so precipitate in cutting out the trees already planted. A year or two ago Mr. J. Cameron, Superintendent, Government Gardens, Bangalore, published an interesting note on the Ceara rubber tree (*Manihot glaziovii*), and its possible utility in the Mysore State. From the date of its introduction in 1879 the Ceara took kindly to the climate of Mysore, and though Mr. Cameron described it as of all the trees latterly introduced the easiest to cultivate, yet till quite recently it has attracted little or no attention. It was planted extensively by coffee planters sixteen and seventeen years ago, the greatest care being taken to file each seed in order to expedite germination. In the next decade, however, the price of rubber went down and that of coffee went up; and the Ceara which subsequently reproduced itself in large quantities were voted a troublesome weed and for the most part uprooted. Here and there, however, some trees survived this period of unpopularity, and when in course of time the old order changed, as it is always doing in tropical agriculture, and rubber went up, while coffee went down, the now well-grown Ceara trees provide the best opportunity for making experiments. Those carried out at the Lal Bagh at Bangalore were especially instructive, though Mr. Cameron admitted on their conclusion that there was still much to be learned about tapping the tree and preparing good marketable rubber. But he made what is rightly styled the remarkable discovery that a single Ceara rubber tree would yield 7 lbs. of rubber during the year without being in the slightest exhausted. The produce of Mr. Cameron's trees was valued by London brokers at 3*s.* per lb. As he remarked at the time, to hear that a Ceara rubber tree was worth a guinea a year was certainly most encouraging, and he concluded that "if the average result in working a large plantation amounted to half or even a quarter of that amount, it will still be a good industry. Ceara rubber is grown successfully in Ceylon at elevations of 2,300 and 2,700 feet."

GUTTA-PERCHA PLANTING IN JAVA.

(From the *India Rubber World*, Vol. XXXIX., No. 6, March, 1909.)

The importance to the world of commerce, of the work that is being done in Java in cultivating gutta-percha can hardly be over-estimated. Indeed, until the writer personally met Dr. W. R. Tromp de Haas, the superintendent of the Government gutta plantations in

Java, and went through the whole subject step by step, he had but a vague idea of the subject.

To begin with, only three of the many gutta-producing trees produce gum fit for cable insulation, and at the same time adapted for profitable propagation. Botanically, they are all species of the genus *Palaquium*, being respectively *P. oblongifolium*, *P. Bornéense*, and *P. gutta*. (This genus, by the way, is better known to English readers as *Dichopsis*.) The species referred to grow chiefly in the Dutch possessions in Java, Sumatra, and Borneo. The natives, whom it is impossible to control, always destroy the tree when extracting the gum. Hence the supply from wild sources is sure to cease ere long. Then, too, as the tree matures slowly, not reaching a tapable size under fifteen years, planters are not interested in it.

As far back as 1856 a small plantation of gutta-percha trees was started in Banjoemas, Java, but it was not until 1885 that Professor Treub really laid the foundation for work on a large scale by starting the plantation at Tjipetir, on the same island. Then, in 1900, when it was decided to do the work on a large scale, there was at hand an abundance of seed. As the seeds perish within four weeks after maturity, and as the bats carry off much of the fruit, which they consume on the wing, the difficulties in getting sufficient fresh seed are obvious.

The time will come, however, when every mile of the 247,888 miles or more of submarine cable now existing must be renewed, to say nothing of the need for new cable lines. And in view of this the Dutch Government took hold of the problem in a manner that assures its solution.

The great plantation at Tjipetir is situated in a healthy country in the uplands not far from Buitenzorg. The rainfall is abundant, the soil good, and cheap labour plentiful. The seeds are first planted in nurseries. When about a year old they are taken up, the tap root and young stem is shortened, and they are planted about 4 feet apart. After the third year the plants have closed up so that they need thinning out.

Almost from the first Dr. Tromp de Haas planned to make use of the leaf and the bark of the plants that were destroyed in thinning. He even went further and extracted gutta from the fallen leaves that littered the ground in the older plantings. All of this extraction is by chemical means, and the product is not the green gutta once on the market, but a high-grade gutta as good as the best. This will be seen to be practical when it is remembered that the bark contains 5 per cent. of gutta-percha (made up of 85 per cent. gutta and 15 per cent. resinous matter), and fresh leaves contain 10 per cent. of gutta-percha (made up of 90 per cent. gutta and 10 per cent. resinous matter). The yield from fallen leaves is smaller, but worth considering.

In this manner the plantation begins to produce when the trees are three years old. By pruning and thinning they have got for the third year about 890 kilograms (=1,958 pounds of fresh leaf to the acre, and the year following 2,744 kilos (=6,037 pounds) of fresh leaf. From the older trees they found that the fallen leaves amounted to about 20 kilos (=55 pounds) a tree. These figures are of course only approximate, as the experiments are still going on, but they are successful and show wonderful skill, forethought, and thoroughness. Beyond all this the almond-shaped seed has been found to produce a vegetable fat with a high melting point which can be used in the arts. It is planned that the real tapping of trees shall begin in 1915. The planting now embraces 2,240 acres, and the estimate is made that it will produce 11 kilos of dry gutta-percha per acre, or a total of 26,810 kilos (=59,048 pounds) a year.

The amount of gutta-percha which has gone into commercial use during the last half century is evidence that a tremendous number of trees yielding this gum existed at the time when the material first came to the notice of manufacturers, but just as the largest bank account will some time disappear if constantly drawn upon without any additions being made to it, the native gutta-percha resources in the regions which formerly supplied the world's principal needs for this material have become well nigh exhausted. It is almost impossible now to find a native specimen of the best gutta-percha species. The practicability from a scientific standpoint of producing guttapercha under cultivation having been established, the owners of private capital naturally hesitated to undertake planting, on account of the supposed length of time which would be requisite for returns, since the gutta-percha trees felled by the collectors were commonly supposed to be a century old.

A well-established Government, however, such as that in the Dutch colonies, accustomed to making investments for the future as well as for the present, and particularly investments not expected to yield direct dividends, can well afford to finance such an enterprise as planting gutta-percha, regardless of

the length of time which must elapse before the trees become productive. There is all the more reason for the Dutch Government to undertake this work in the fact that gutta-percha trees occur naturally over so small an area, and that embraced principally in the Dutch possessions. There is now being laid a cable, insulated with gutta-percha, between Germany and Brazil to be one of the longest cables in the world, and there is no indication that the age of cable building is passing. Ultimately, at the present rate of consumption, there will be no forest gutta-percha, and all the activity of the Dutch government and such private enterprise as it may inspire can hardly lead to over-production of this important material when the world's need for it becomes acute.

It is true that gutta-percha trees under cultivation may mature at an earlier age than where they are scattered in forests, just as has proved true of *Hevea* rubber in Ceylon and Malaya. The fact is also important that science has demonstrated the possibility of obtaining gutta-percha from young trees. The most important substitute for gutta-percha yet known is balata, of which important native resources still exist, and in connection with which some facts are given in a brief article which follows.

GUAYULE RUBBER. I.

By THEODORE WHITTELSEY.

(From the *Journal of Industrial and Engineering Chemistry*, Vol. I., No. 4, April, 1909.)

It has long been known that the natives of Mexico in some of their games use balls composed of an elastic substance which they obtain by chewing the bark of a shrub called Guayule. Attempts have been made from time to time to introduce this substance industrially, but without success until recently. The first practical experimentation on a commercial scale seems to have been made in 1903-4. In the following year the product, which has been found to be a true rubber, began to be put on the market. From this time on the industry developed with extraordinary rapidity, and the excitement in northern Mexico is said to have been comparable to that in Texas when the oil fields were discovered. By 1906 practically all the Guayule within reach of existing transportation facilities was contracted for.

The Guayule, *Parthenium argentatum*, is found on the semi-arid lands of the plateau of northern Mexico, growing in the dry, rocky soil of the foot-hills. It is not large; the dimensions of plants of factory size are approximately as follows:—

Height.	Dry weight.	Diameter at base of trunk.
12 inches	6 ounces	$\frac{7}{8}$ inches
20 ,,	12 ,,	$1\frac{1}{8}$,,
36 ,,	32 ,,	$2\frac{1}{4}$,,

The acreage weight of factory shrub is probably between 12 and 16 ounces. The plant shown in the cut is an exceptionally large one, weighing $5\frac{3}{4}$ lbs. It was $44\frac{1}{2}$ inches high and $2\frac{1}{4}$ inches in diameter at the ground level.

The shrub is collected by pulling up the entire plant, and is pressed either in the field or at the railway station into bales weighing from 80 to 120 kilos. In 1904 these are said to have brought 7 pesos* per ton; in 1905 the price had risen to 30 or 40 pesos, and recently has been above 100 pesos.

The Guayule contains in the neighbourhood of 9 per cent. of pure rubber, calculated to the perfectly dry plant. The methods that may be used to extract the crude rubber are entirely different from those used with most rubber plants. These contain a milky juice or latex from which the rubber is obtained by coagulation, while in the Guayule the rubber exists as such preformed in the plant. The earlier processes were of three types: (1) the alkali process, in which the shrub was boiled with a solution of caustic alkali; (2) the solution processes in which the rubber was extracted by carbon bisulphide or some other solvent; and (3) the mechanical process. The first of these is still used in apparently only one factory. According to the patent specifications, the ground shrub is boiled with three times its weight of 6 per cent. caustic soda for six hours, after which the rubber is skimmed off and freed from alkali. Of the second class, the carbon bisulphide method has been abandoned, because of the expense and the belief that rubber when recovered from a solvent does not possess certain desirable physical qualities to the same degree as an undissolved rubber. A process that belongs to this type has been extensively experimented with in a new factory during the past two years. This process is said to be based on the extraction of the dried shrub with benzol. A solution of rubber and resin is obtained, from which the former is pecipitated by the addition of alcohol. It has been prophesied that this process will prove a failure for the same reasons that have led to the abandonment of the bisulphide extraction, but the product is now on the New York

* peso = $0·50 gold.

market, and the outcome is awaited with interest. Rubber produced in this way should run lower in resin than that obtained directly by the other processes. The great bulk of the Guayule rubber now coming into the market is obtained by the third, the mechanical process. In this the shrub is crushed and then ground with water in pebble-mills. The rubber in the plant then becomes apparent as small particles $\frac{1}{16}$ inch in diameter and from $\frac{1}{16}$ to $\frac{1}{8}$ inch long. The details of the succeeding operations to separate the rubber from the woody matter are for the most part kept secret and doubtless vary in different factories, but it may be said in a general way that the procedure is based on the fact that when soaked with water the woody fibre becomes water-lodged and sinks, while the rubber being lighter than water floats on the surface of the tanks and is skimmed off. It is then washed, sheeted on steel rolls, and either shipped moist or first dried by hanging the sheets in any airy room or by heating gently in a vacuum. If the mechanical process is properly conducted, a practically complete extraction of the rubber from the shrub is secured.

Guayule rubber obtained by the mechanical process is black on the surface when it reaches the market, but olive to light brown within. The dry crude rubber contains about 20 per cent. resin. Some factories also produce a brand from which the resin has been in great part extracted, but the demand for this seems comparatively small. Guayule rubber softens more quickly on the rolls than most other rubbers, and therefore requires to be handled somewhat differently, but once this is understood, the working of Guayule rubber of good quality presents no difficulty. It can be substituted for many of the African rubbers, is used to advantage in boots and shoes and many other lines of manufacturing, and seems to be growing in favour. The Guayule rubber recently reported as received at the port of New York was—September 850,000 lbs., October 929,500 lbs., November 1,444,000 lbs.

DYES AND TANS.

BLACK WATTLE. (*ACACIA DECURRENS*).

By D. E. Hutchins.

(From the *Agricultural Journal of British East Africa*, I., Pt. I., April, 1909.)

The well-known Wattle that has been so largely planted in Natal (under the name of *A. Mollisima*) is *Acacia decurrens* variety mollis. The average production of bark, mine-poles and firewood is estimated as being worth £100,000 a year for Natal, £75,000 for bark and £25,000 for poles used locally or sent to the mines. It grows best in Natal at elevations between Maritsburg and Colenso, particularly along the so-called "mist belts." The coastwise limit of good growth is at Inchanga 2,000 feet elevation, 40 inches rainfall, and about 30 miles from the sea. The mean temperature at Inchanga would be about 63° or 64° which is the mean temperature of Nairobi. There are several varieties of Black Wattle, viz., *mollis normalis, pauciglandulosa, leichardtii.* The three last occur in Queensland. Two at least of these are growing in Natal. *A. decurrens* var. mollis is the commonest in Australia, and that which is almost exclusively planted in Natal, Cape Colony and the Transvaal. *Normalis* is the local Sydney variety, and *leichardtii* and *pauciglandulosa* local varieties found north of this as far as the tropics. As an ornamental tree the normalis variety is the prettiest with its delicate foliage, like that of Asparagus creeper in our ferneries. At Tokai near Cape Town this variety has been grown sufficiently abundantly to yield a fair supply of seed. I have seen occasional specimens of it in Natal. It is well worth growing as an ornamental tree. The Black Wattle is one of the "Golden Wattles" of Australia, and all its varieties most beautiful when in flower in Spring.

Those who wish to consult an Australian work on the subject of Wattle growing cannot do better than read "Wattles and Wattle Barks, being hints on the conservation and cultivation of Wattles, together with particulars of their value" by J. H. Maiden, Government Botanist, N. S. Wales. (Technical Educational Series, No. 6, Sydney.)

Those who are interested in Black Wattle cultivation in Natal should read an excellent paper by Mr. T. R. Sim, Conservator of Forests, printed in a recent number of the Natal Agricultural Journal.

The data given below are extracted from Mr. Sim's paper and my own otes during a visit to Natal.

Average data :—Conservator of Forests, Natal,

RAINFALL.

From 20 inches, if soil is deep and moist and mist frequent 30 inches to 40 inches most suitable.

Price of land £1 to £6.

Cartage limits killing profits. } Fuel 8-10 miles. Mine props 16-20 miles.

SEED PER ACRE.

In lines 1 lb. to 1½ lbs.
Broadcast 3 lbs. to 5 lbs.

THINNING.

Cut out dominated stems, prune back dominating stems ; first unremunerative thinning at 3 or 4 years ; keep as far apart as you can so long as canopy is maintained and stems are clean. Usual final espacement 6-10 feet or 220 to 400 stems per acre.

CROP.

Time from 5 years : average 10 years.

YIELD.

Average 5 tons of dry bark, 30 tons of dry timber.

PRICE.

Bark average at Dalton, the centre of Noodeberg district : £6 to £6 10s. per ton for bark in bundles.

Ground and bagged £1 more.

Fuel £5 to £20 per truck of 20 tons.

Pit props (heavy) double fuel prices.

There are some 30,000 acres of Black Wattle plantations in Natal.

Owing to the dry weather in 1906 hindering the stripping of the trees, the Natal export of Wattle bark fell from £112,000 worth in 1905 to 80,000 worth in 1906. A considerable increase is, however, looked for during 1907. The price of bark for 1907 is about £1 per ton higher than in 1906. Owing to the extent of land suited for the growth of this tree being somewhat limited, such lands have changed hands at prices varying from £5 to £10 per acre. £6 per acre may be looked on as the average value of good Wattle land in Natal. In Natal the industry is now a well-established and, generally speaking, a profitable one.

YIELD OF FIREWOOD.

The yield in firewood, at 40 lbs. per c. ft. and cropping at 10 years, amounts to a mean yearly timber yield (Acrim) of 150 c. ft. Where the Wattles grow very quickly and can be cut at 5 years the Acrim would be 300 c. ft. The Black Wattle grows as well in the Eastern districts of Cape Colony as in Natal. The average over 643 acres of wattle plantation (mostly Black Wattle) at Fort Cunnynghame, cropped at seven years, was an Acrim of 83 c. ft. (Sim in For. F. of Cape Colony).

In the Transkeian district of Cape Colony where there has been much destruction of forest by natives, special plantations of Black Wattle have been formed to supply the natives with poles and thus save the young trees in the forest.

An average sample of Natal Black Wattle analysed by Mr. A. Pardy, F.G.S., of Maritzburg gave :—

Soluble matter	...	...	47·90
Non-tannin	...	...	11·94
Tanning matter	...	...	35·96
			95·80

BLACK WATTLE PLANTING EXPERIMENT.

The planting of Black Wattle in British East Africa can at present be looked upon as an experiment only. At best, it is a climatic exiotic here, its success depending on *altitude compensating latitude*, and herein is a serious element of doubt. In the early days of tree-planting on the Rand (Johannesburg) it was commonly remarked that every South African tree would grow. Here it was assumed that altitude would compensate latitude ; but after a few years the numbers of successful introductions rapidly fell off ; and every severe year since, (either of frost or drought), has marked a further elimination of the unfit.

On the Nilgiris, in Southern India, the climatic conditions almost exactly repeat those of the highlands of British East Africa. Between 35 and 40 years ago a number of extra-tropical trees were introduced, and a few of these have thriven amazingly. In no part of the world does the Blue-gum (Euc. globulus) yield higher returns. One of the Himalayan pines, *Pinus longifolia*, has for a pine an almost equally remarkable growth. When first introduced on the Nilgiris the Dealbata variety of Black Wattle grew well. After a few years, however, it gradually altered its flowering period, and degenerated, in most localities, to a nearly worthless scrub about 30 feet high. In 1883 I averaged the yield of Black Wattle on the Nilgiris at 3 tons (dry wood) per acre per annum. Mr. Cowley Brown, a Madras Forest officer who has recently written an extremely interesting report on the Australian and other trees introduced on the Nilgiris, states that now the yield is under 3 tons per acre per annum. When I left the Nilgiris in 1880 the Silver Wattle was looked on as a pest, and people were paying at the rate of £10 per acre to have it dug out, root and branch, from the compounds of houses.

So far appearances are in favour of the Black Wattle succeeding better on

the highlands of British East Africa than on the Nilgiris; though a tendency to branch from the roots has already been remarked by Mr. Battiscombe, and young wattles in plantations near Nairobi sometimes die off without any assignable reason. At Messrs. Favre and Felix's plantations the Black Wattle looks well. It is still, however, quite young. I saw there none of the ordinary mollis variety. It is all *var normalis*, with a little *leichardtii* and *dealbata*. In the Railway plantation at Nairobi the Black Wattle (*mollis var*) does not look well, but the situation is unfavourable. At the French Mission near Nairobi there is a fine avenue of quite healthy Wattles: this is a var mollis. At Nakuru I saw some healthy-looking Black Wattle (*mollis*) which is stated to be now over four years old.

Black Wattle has been planted for five years in British East Africa, and the growth, up to the present, is generally good. The different varieties are growing so far with equal vigour. It is stated that a sample of bark from the oldest trees at Nakuru has lately been sent to Natal and given a good analysis of bark.

DYE STUFFS.

(From the *Report on the Work of the Imperial Institute*, 1906-1907, No. 584.)

Samples reported on during 1906.	No.	Samples reported on during 1907.	No.	Samples awaiting investigation at the end of 1907.	No.
Lagos ..	1	Sierra Leone	1	Nil	
Rhodesia ..	2	Rhodesia	1		
		Sudan	2		
		Seychelles	4		
		India	4		
		Miscellaneous	3		
Total ..	3	Total ..	15		Nil

Natural dye stuffs are now of little or no economic importance, and with the exception of indigo and a few of the yellow dyewoods and logwood, they have been almost entirely supplanted in European dyehouses by synthetic dyes of chemical origin.

1906.—The samples received in 1906 consisted of annatto seeds from Lagos and native-made indigos from Rhodesia. Annatto is still used to a considerable extent in colouring butter and margarine. The Lagos sample was of good quality. The Rhodesian indigos contained only 3·7 to 18·5 per cent. of real indigo, and were of no value for export purposes.

1907.—The "Gara" plant is used as a blue dye stuff in West Africa. It contains indigotin identical with that present in the various species of *Indigofera* used as sources of indigo in India, Java and elsewhere.

The Sudan samples were of the red dye "Sikhtiyan," derived from a species of "dura," the stems of which secrete the red colouring matter. The latter was shown to be a substantive red dye of the type present in red sandalwood.

The Seychelles samples were "orchella weeds," for which there is still some slight demand as a dye. Three of these samples were of good quality and equal to the weed now exported from Ceylon and Portuguese East Africa.

Of the three Indian dye stuffs *Onosmea echioides* contained a red dye like that present in alkanet root; *Hibiscus Sabdariffa*, two yellow colouring matters, one of which is of the quercetin type of yellow dye; and *Thespesia Lampas*, the yellow colouring matter quercetin. In *Baccaurea sapida* no evidence of the possession of tinctorial properties could be obtained.

During 1907 a memorandum describing the cultivation of annatto and the preparation of the seed and dye for the market was prepared for the Government of Ceylon.

The miscellaneous dye stuffs received were mainly from commercial firms in this country, and included camwood and several lichens of the orchella and other type.

FIBRES.

NEW FIBRES FOR PAPER.—IV.

By WILLIAM RAITT.

FACTORS OTHER THAN CELLULOSE.

The modern division of paper-making into (1) pulp manufacture, and (2) paper manufacture proper, has greatly extended the area from which it is possible to draw supplies of raw material, by eliminating freight cost on the waste: whereas formerly the paper-maker had to import from 2 to 3 tons of material to produce a ton of paper, he now imports the pure cellulose from the pulp maker, from which he can produce 90 to 95 % of paper. As a matter of trade con-

venience the division suits both parties. The pulpmaker's principal interest is to be near his sources of raw material, and the paper-maker's to be close to his market, since he has to meet a demand which is continually varying in its requirements of quality, colour, size, weight and finish.

The search for new sources of paper-making material can therefore be conducted solely from the view point of the pulp maker, and it may be useful to the non-expert observer if we conclude this series by indicating the chief considerations other than an abundant supply of raw material necessary to the successful conduct of a paper-making enterprise. Unless these exist in association with, or within economic reach of, the material, the most promising supply of the latter may be comparatively useless. If they do exist in more or less abundance, a *prima facie* case may be established for submission to expert examination to ascertain their exact value, and the compensatory effect which the excellence or abundance of any one or more of them may have upon the deficiency or inferiority of others.

We will assume that a perennial supply of raw material, yielding a paying percentage of useful cellulose is in sight. The most important of the other necessary factors are as follows :—

(*a*) Site for mill—its position with respect to export of the manufactured goods, and the facilities for bringing the raw material to it, in cases where it must be at some distance from its supplies. Cases may occur where it may be important to decide whether the mill had better be situated close to the raw material, or near a port of export. The ideal, of course, is for material, mill site, and port to exist together.

(*b*) Labour—especially the forest labour required for cutting, collection and transport of material.

(*c*) Source of Power—either steam or water-power. In the case of the latter electrical transmission from a distance may be feasible.

(*d*) Fuel for manufacturing purposes—waste timber will usually be available, but where the driving power must be steam, it may be necessary to have a supply of coal.

(*e*) Water for manufacturing purposes—a plentiful supply, clean and bright, or capable of being made so by simple settling and filtering arrangements.

(*f*) A supply of lime within economical reach—with these in sight plus raw material, a fair case can be made out for full and exacting enquiry into the possibilities of a pulp-making industry.

Judging from some enquiries received, it seems necessary to specify exactly what is meant by "pulp" in this connection. I have, for instance, been asked if the waste 'pulp' produced in separating Aloe fibre from the leaf is of use. The more technical term of 'half-stuff', that is, half-made paper, describes it more precisely. It consists of the nearly pure fibre or cellulose of the plant, separated and isolated from the lignose and pectose constituents by chemical and mechanical means, made into thick slabs and dried. Though sometimes bleached by the European and American paper-makers, it will be preferable to export it from the tropics in the unbleached condition, and the bleaching, if necessary, done by the paper-maker.

As we have been dealing with *new* fibres for paper, we have not considered it necessary hitherto to make any reference to new sources of *old* fibres. In South Eastern Asia these may be said, speaking broadly, not to exist; but an exception must be made in favour of the higher ranges of the Himalayan region containing varieties of Spruce and pine similar in composition to those now being used in Europe and America as pulpwoods. When we consider the splendid floatway and water powers afforded by the Himalayan rivers, the possibility of pulpmaking there does not appear to be remote; but apart from this, suitable soft-wooded non-resinous timbers are, in the tropics and sub-tropics, conspicuous by their absence in sufficient abundance to warrant attention.

Mr. Gladstone's phrase, "the consumption of paper is the measure of a people's culture," has passed into a commonplace, and although doubts may be held as to what extent the consumption of the yellow press, the penny dreadful and the sixpenny awful, is represented by culture, yet in the main it may be accepted as a pregnant and suggestive truth, and especially so in the case of a people just emerging from ignorance into knowledge. The struggle to reach a higher plane may be protracted and apparently doubtful, the gropings in the dim of the dawn wearisome and disappointing, but the bound into fuller light is apt to come with the suddenness of sunrise. It is this which makes any prophecy as to the future requirements of the chief medium in the distribution of culture somewhat like guesswork. In the United Kingdom the average consumption per head of population is something like 50 lbs. per annum. In Bosnia it is 1 lb., in India one-tenth of a pound. At any moment a sudden advance of such communities in

the scale of culture may create a situation parallel to that between 1890 and 1907, when the world's consumption increased from under three million tons to eight millions per annum. But if we leave such spurts out of account, and base estimates on the steady and normal growth only of the past few years, we shall open out a prospect quite sufficiently encouraging to the pioneers of new sources of supply; and in putting the present deficiency at 250,000 tons per annum, and estimating a gradual growth in the demand, *in excess of what present sources can supply*, amounting ten years hence to one and a half million tons, we shall be on perfectly safe ground.

COTTON.

By J. E. Jones.

(From the *Agricultural Journal of British East Africa*, Vol. I., Part 2, July, 1908.)

It is a commonplace remark that great results often come about from insignificant causes, but it is nevertheless in many instances perfectly true. In no case is it more so than in the generally accepted version of the introduction of Cotton and the commencement of its cultivation in Egypt. The story goes that a Turkish Dervish on his way home from India, presented an important personage in Egypt of the name of Maho-Bey el Orfali with some Cotton seed which he had obtained in India. These were planted and the bushes retained as ornamental shrubs until a wandering Swiss of the name of Immel saw them and recognised their value. He persuaded Maho-Bey to cultivate the Cotton seriously, which he did with complete success. This was the beginning of the present era of Cotton growing in Egypt.

From researches made by many eminent botanists, it has been conclusively proved that there existed an indigenous type of Cotton in Egypt previous to the enterprise of Maho-Bey. "Cotton," under the name "Gossypium" was known to post classical Roman writers, and the word is evidently derived from Greek. That bears witness to the antiquity of the plant. It is quite possible that the Romans, who were for a long period in possession of Egypt, obtained their knowledge of it from that country. However that may be, and however old its origin, it had become an absolutely degenerate product previous to 1800 or so, for that is approximately the date of the introduction of the above mentioned Indian seed to Egypt. From that date to this the cultivation of Cotton has expanded so greatly, that it is now probably the most important product of the world, giving employment to countless thousands.

To-day we have in Egypt several varieties, the principal of which are,

(1) Achmouni.
(2) Gallini.
(3) Bamieh.
(4) Mitafifi.
(5) Abassi.
(6) Janovitch.

How these varieties arose it is difficult to trace satisfactorily, in all cases, but some are the results of crossing and hybridisation. It is possible also that climate and soil play an important part in determining the colour, length and fineness of staple of a particular class.

Their chief characteristics are :—

1. Achmouni.—Slightly brown, plant short, yield only moderate, moreover it does not yield well in the Ginnery; most probably a variety of Gossypium Barbadense, type ægyptiacum. Taken its name from Achmoun, a town in Menoufieh.

2. Gallini.—A sub-variety of Sea Island. Yields fairly but requires water. Ripens very slowly. The staple is long.

3. Bamieh.—Taken its name from a Garden plant (*Hibicus esculentus*) which it resembles. Long, fine staple; it suffers from variations of climate and must be regularly watered. Cultivation generally abandoned.

4. Mitafifi.—The chief variety of Gossipium barbadense, though it bears traces of other varieties. It is also called "Sukari" owing to the fact that its brownish colour resembles that of burnt sugar. It made its first appearance at Mitafifi in Menoufieh about 1884, since which date its cultivation has been enormously extended. It is currently supposed that its brown colouration is due to action of salt in the ground, a statement which is borne out by the fact that Afifi grown near the Coast at Malindi is browner than that grown inland.

Its chief features are—long staple, heavy yield both in the field and Ginnery, and the fact that climatic conditions have less effect on its vegetation than on any other variety.

5. Abassi.—This variety gives a brilliant Cotton. White in colour and a stronger and finer staple than Mitafifi. It was evolved originally by a Greek named Zafiri out of a prior variety called Zafiri which was itself a variety of Mitafifi. It is cultivated extensively in Egypt, and realises a higher price than Mitafifi but, as a crop, it is not so productive as the latter.

6. JANOVITCH.—This—the longest and finest staple cotton in Egypt—was discovered by an Albanian named Janovitch. It is the form of Mitafifi, resembling the latter in its leaf and flower. Unfortunately its cultivation demands great care and skilled labour, and, though it fetches the highest prices, its productivity is less than Abassi or Mitafifi. A peculiarity of it is that the moment it is ripe it falls, and the picking season must consequently involve constant supervision.

These are the six chief varieties in Egypt at the present time, and out of this number, only the three latter are cultivated extensively. But there are two others which are found there, namely, "Hindi" and "Sea Island." The former is mostly found mixed with Mitafifi. It is of two varieties, one bearing a short, and the other a long plant. The flowers are different to those of Mitafifi. They are white, slightly yellow with no red ring round the base. The capsules also contain four and sometimes five valves instead of the usual three. The cotton itself is white, of moderate length, and once the boll is open, a slight shower of rain will cause considerable damage.

Considerable progress has been made with the planting of "Sea Island" in Egypt lately, and actual experiments have proved that, side by side with Abassi, the yield is if anything slightly superior. It has the undoubted advantage of being higher in price, fetching at home just over 1s. 3d. per lb.

In choosing what variety of cotton to cultivate, the Planters must keep in view the following:—

(1) The choice of a plant of quick growth, which is least subject to variation of temperature and atmospheric conditions.

(2) The choice of a variety that yields best in the field and in the Ginnery. The amount produced per acre must vary according to locality and rainfall, but the yield in the Ginnery should be a third or more of the seed Cotton.

(3) The choice of a cotton yielding the longest, finest and highest priced fibre.

Looking over above varieties, one must conclude that the most suitable for use in B. E. A. are Mitafifi and Abassi, and these are the two that are generally planted in the Coast belt. It may soon be found, for Planters are making experiments this year that Sea Island will be a success on our alluvial soils, but previous experiments of this variety sown in the lighter soils have proved failures.

After deciding on what variety to sow, the Planter must next secure good seed. So far all seed has been imported direct from Egypt, and it will be wise to continue this practice for two or three years to come. But as nearly every plant takes sooner or later some characteristics from the soil into which it is imported, we shall probably find that the Cotton grown on the Coast will be differentiated from that of Egypt in certain ways. It has already been proved that Mitafifi does not give us that creamy burnt sugar colour which is its main feature in Egypt, and in course of time a new type of this Cotton will be evolved in this country if a proper selection of seed is made.

There are three methods by which a proper selection can be made.

(1.) *In the Ginneries.*—This is a very doubtful process, especially whereas in this country the quality of the Cotton varies so much. A proper selection by this method presupposes the employment of an expert at each Ginnery.

(2.) *By Planting Selected Areas.*—This could easily be done on the alluvial soils of the Coast where a certain acreage could be set apart, carefully cultivated and the seed from it selected for sowing.

(3.) *By the employment of certain Planters for the special purpose of Cotton exclusively for seed.*—In certain parts of America there are Planters who devote themselves exclusively to this purpose, and very successful the practice has been.

In any case the selection of seed should be under a Government expert, preferably a man of experience in Egypt.

Cultivation of Cotton--So much has been said and written on this, that it is hardly necessary for me to do more than touch on a few points.

Cotton has long passed its elementary stage here, and there are quite a number of experienced Planters on the Coast by this time who have taught not only the natives in their actual employ, but others as well. Hence the cultivation of Cotton on the Coast is rapidly growing. When one considers that practically it was only begun in 1904, its expansion is not a little marvellous.

The chief points to consider:—

(1.) *To plant in straight rows in ridges or on the flat.*—That depends entirely on the soil. It may be stated at once that water-logged soil is absolutely unsuitable for cotton. If, owing to a heavy fall, rain water is likely to stand on a shumba

for a little time, it is advisable to sow on ridges. If, however, the soil is porous, sowing on the flat is best.

(2.) *To keep the Cotton clean.*—That is essential, for the plant must have light and air in order to make good growth. If grass is allowed to encumber it, it will grow up into a weedy plant, the leaves of which will speedily turn yellow. The yield consequently will be poor. The number of weedings necessary in a season will depend entirely on the quantity and quality of the grass and on the rain.

(3.) *To pick the Cotton clean.*—This is of vital importance to the Planter if he wishes to secure good prices. He will himself realise the importance of exercising constant supervision while the picking is going on.

(4.) *To grade the Cotton.*—This is almost as important as the last point, for in case of good and bad cotton being mixed, the Planter will only obtain the price current for his lower quality. No consideration is paid to the fact that there may be good cotton mixed up with it.

Cost of Production.—It is difficult to make even a general estimate of this. So much depends on the quality of the soil, the presence or absence of thick bush, and the quality of the labour. When land is moderately covered with bush, it will cost approximately £2 per acre to clear, burn and stump. In addition to that, there is the cost of hoeing, sowing, cleaning and picking; the total amount of which may be estimated at another £2, making £4 in all. This is a moderate estimate for the first year's work.

The yield should be about 750 lbs. of seed cotton (Abassi) and abont 1,000 lbs. Afifi. After adding the cost of ginning, handling and freight, brokerage, etc., it should leave a profit to the Planters.

But as long as labour is purely manual, no fortunes will be made. The use of oxen and ploughs will not only cheapen, but also improve cultivation, and it is to be sincerely hoped that in a short time it will be found possible to utilise them on every plantation,

PICKING COTTON.

(From the *Queensland Agricultural Journal*, Vol. XXII., Part 2, February, 1909.)

There is no difficulty in picking well-ripened cotton, but much judgement is required to pick properly and to the best advantage. Where pickers are engaged to pick at so much per cwt., it is manifestly to their advantage to pick rapidly, and in so doing not to be very particular as to selecting the best, ripest, and cleanest bolls. Unless the clean cotton is kept apart from that which is stained, additional expense and loss of time are incurred by the grower and the ginner, in sorting it on arrival at the ginnery. We write from experience on this matter, as it was no uncommon thing to pick out from 10 to 20 lb. weight of stained cotton when delivered at the gin house by the farmer, and this in addition to such added trifles as stones, gravel, horse shoes, and even old boots. It is a very simple matter to so arrange the picking-bag that it shall be provided with a separate pocket, into which the stained bolls may be placed, the clean cotton going into a larger receptacle. The usual custom, in the old days of cotton-growing in Queensland, was to bag the cotton after only a few hours' exposure to the sun, and to cart it in at once to the ginnery, causing great loss to the buyer. Cotton should, after being dried, be kept in store for three or four weeks before being ginned, and turned over several times until the seed is so dry that it will crack between the teeth.

The "Cyprus Journal" has the following notes on picking:—

When the cotton-picking season begins, cotton-growers would do well to bear in mind the following hints:—

Do not leave the ripe cotton too long on the plants, but pick as soon as it is ripe.

Send all pickers, as far as possible, together to one field. In this way more careful supervision can be kept on the pickers and the cotton picked.

Stained and dirty cotton, when picked, should be put apart at once from the clean cotton. For this purpose a pocket on the picking-bag is very useful. It is easier to separate the stained cotton at the time of picking than afterwards.

Cotton, when cleaned and dried, should be kept in store from three to six weeks before being sent to the ginnery

Cottons of different qualities should not be mixed.

COTTON IN THE SEA ISLANDS.

(From the *Agricultural News*, Vol. VIII., No. 177, February 6, 1909.)

The market prices for cotton from the Sea Islands still remain very low as compared with those which prevailed a year ago. The demand, however, is stated to be good, and it is possible that prices may improve somewhat. In their

Sea Island cotton report, dated January 9 last, Messrs. Henry W. Frost & Co., of Charleston, write :—

There was an active demand throughout the week, resulting in the sale of a total of 1,900 bales of cotton from Charleston, and 3,144 bales from Savanah. (These sales, of course, include cotton of coarser grade from Florida and Georgia, as well as the finer quality lint from Carolina.) The prevailing prices for Islands cotton are as follows :—"Extra fine" quality, 13d. per lb. ; "fully fine" 12¼d. to 12½d., "fine" 11d., tinged cotton, 9¼d. ; and stains, 7½d. to 8d. per lb. The buying was general for England, France, and the Northern mills. As the entire stock of odd bags has been sold, we are now dependent on future receipts for graded cotton. No sales of 'planters crops' cotton have been made, since factors are unwilling to accept current prices.

The total amount of American Sea Island cotton ginned up to January 1 of the present year has been 86,016 bales, as compared with 73,425 bales ginned to same date last year. The present year's crop (American) is estimated at 100,000 bales.

On January 16, Messrs. Frost & Co., write :—

There has again been an active demand throughout the week for all the offerings of odd bags of all grades, and also for all the crop lots of "fully fine" quality, which could be purchased up to 13d., leaving the market swept of all offerings excepting crop lots held at 13½d. and upwards. In view of reduced stock, factors are now disposed to hold these with more confidence, as the receipts from now on are expected to be small.

ORIGIN AND ESTABLISHMENT OF THE BARBADOS CO-OPERATIVE COTTON FACTORY.

BY HON. F. J. CLARKE, C.M.G., M.A.,

President of the Barbados Agricultural Society.

(From the *West Indian Bulletin*, Vol. IX., No. 3, 1908.)

With a view to encouraging the cultivation of cotton and onions in this island, the Imperial Commissioner suggested that the Barbados Agricultural Society should appoint a Committee to co-operate with the Imperial Department of Agriculture with that object.

This Committee was appointed on Febuary 6, 1903. It consisted of seven members, Sir Daniel Morris being one, and I had the honour of being the Chairman. Subsequently four others were added to the Committee,

The Committee at once decided that the first step to be taken in encouraging the cultivation of cotton was the erection of a ginnery. There were then a few trial plots of cotton which had been planted at the suggestion of the Imperial Commissioner. The Committee was lent one of three gins and one of three baling presses sent out to the Imperial Commissioner by the British Cotton-Growing Association.

On the application of the Committee, the Government lent them a wooden building which had been erected as a small-pox hospital, which was no longer required for that purpose, and a site on the pierhead for the erection of the ginnery. The British Cotton-Growing Association lent them two gins.

The Legislature voted and placed at the disposal of the Committee £250 for erection purposes.

A second-hand engine and boiler and the necessary fittings were bought, and the ginnery on its completion was formally opened by Lady Morris on July 31, 1903. The result of the first year's working was satisfactory, and as it was found that the next year's cotton crop would be about 800 acres, the Committee decided to enlarge the ginnery.

The British Cotton-Growing Association lent them three more gins and a cotton seed disintegrator, the Legislature voted a further sum of £120, and the British Cotton-Growing Association gave £100 to defray the cost of erection.

The enlarged ginnery was equipped with six gins, a baling press, and a seed disintegrator. It was opened on January 25, 1904.

During the first two years of their work, the Committee were not only helped by the Government in the erecting and enlargement of the ginnery, but money was lent them by the Government to purchase seed-cotton from small growers, and to pay their working expenses. The Imperial Commissioner of Agriculture also lent money for this purpose.

The growers of cotton were now perfectly satisfied with the results obtained so far, and the area in cotton for the season 1904-5 appeared likely to be very much larger than that of the previous year. The Committee therefore decided that the time had arrived when the cotton industry should be carried on without any government or other assistance, they therefore called a meeting of cotton growers and proposed to them that they should form a co-operative company to take over and work the ginnery. This was done, and thus there came into existence the company known as

the Barbados Co-operative Cotton Factory, Ltd., which was registered under the Companies' Act on August 16, 1905, with a Capital of £800 divided into 1,600 shares of 10s. each.

On the formation of the Company, the Government agreed to accept £600 first debenture bonds at 5 per cent, redeemable in 21 years, for the £683 which they had from time to time lent to the Committee, and the British Cotton-Growing Association agreed to accept £150 for the six gins and the distintegrator which they had lent.

The Company worked the ginnery taken over from the Committee for a year, but the Directors found that it would be wholly inadequate to deal with the cotton that would be sent to them the following season, and with the increased amount that was certain to be grown in the future. The Directors therefore proposed to the shareholders that the capital of the Company should be increased so as to erect a very much larger ginnery. This was agreed to on March 20, 1905, and it was decided to issue 16,000 shares at 10s. each. On this number, however, only 10,524 were issued.

The Directors bought the site where the factory stands, ordered the necessary machinery, and commenced work on the new buildings on May 4, 1906. The factory was opened on January 22, 1907.

The working of the factory has been highly satisfactory both to the cotton growers who have had their cotton ginned there, and to the shareholders who have received good dividends.

The factory is equipped with a double expansion engine, a Stirling water tube boiler, twenty-four gins, a hydraulic baling press, and a seed disintegrator.

It is hoped that in the near future oil-extracting machinery will be added.

From small beginnings and through many struggles, there has come into existence the largest Sea Island cotton ginnery in the world.

The following table showing the growth of the cotton industry in this island is of interest as illustrating the increased demand for ginning facilities of which I have spoken in giving the history of the cotton factory :—

TABLE SHOWING THE AREA PLANTED IN COTTON, THE YIELD, AND THE ESTIMATED VALUE OF THE COTTON EXPORTED FROM BARBADOS FROM 1902-7.

Year.	Area planted.	Lint Pounds.	Seed Pounds.	Value of lint. £	Value of Seed at £5 per ton. £	Total Value. £
1902-3 ...	16	5,550	13,450	..	..	318
1903-4 ...	800	192,061	472,510	12,338	1,055	13,443
1904-5 ..	1,647	344,232	846,882	20,869	1,890	22,759
1905-6 ..	2,000	479,418	1,179,463	30,363	2,633	32,996
1906-7 ..	5,000	853,408	2,042,340	72,326	4,560	76,876

The factory has turned out the following amounts of lint:—

Season.	Pounds.	
1902-3 ...	4,826	When under the direction of the Cotton Committee.
1903-4 ...	104,926	
1904-5 ...	215,500	
1905-6 ...	328,341	When owned by the Company.
1906-7 ...	538,507	

For the first three months of the season 1907, 66,667 lbs. have been turned out. The factory purchases seed-cotton chiefly from small growers at a price which is generally about one-fourth of the price of lint on the day of purchase. Cotton is ginned, baled, and shipped for growers, and the money received from England and paid to them at an inclusive price of 3¼c. per lb, of lint.

The seed is either taken over from the growers at £5 per ton or sent to Messrs H. E. Thorne & Son's oil-extracting works at their option. In the latter case the growers are paid a price per ton of seed regulated by the price of oil according to a scale agreed upon between Messrs. Thorne & Son and the Directors of the factory. This, however, does not fall below £5 per ton, and they have returned to them 1,700 lbs. of cotton-cake-meal for each ton of seed.

The factory also sells selected and hand-picked cotton seed at 3d. per lb, to growers in this island and at a slightly higher price to others. The seed from the finest varieties is reserved for this purpose.

Advances are made to growers on the cotton sent by them to be ginned, to the extent of half the value of the lint at a low rate of interest, and to the extent of three-fourths of the price of lint at a slightly higher rate.

Paris green is ordered for growers who wish to get it in large quantities, and a stock of it is kept for those who buy in small quantities.

The Directors endeavour to do everything in their power to help cotton growers.

A VALUABLE FIBRE PLANT: (*ASCLEPIAS SEMILUNATA.*)

BY CHAS. A. WHITE, F.R.H.S., &c.,
Uganda Protectorate; late Forest Officer, Coolgardie, W. A.

(From *Tropical Life*, Vol. V., No. 4, April, 1909.)

When the Coolgardie goldfields were first known, I was an employé in the Melbourne Botanic Gardens, and having been seriously attacked by the gold fever was, with thousands of others who

have been more or less successful, soon upon the field. That was at the end of 1893. Some two years after, while camped near Bulla-Bulling at an old deserted camp, I was astonished to find some oats in full ear; but what struck me principally was a plant producing white clusters of flowers, and large bladder-like capsules containing a fluffy, silky fibre like the Scotch thistle, and producing a white milky substance similar to rubber. This plant must have been brought by seed in imported forage.

When the South African War broke out, I got the war fever, and proceeding to Africa, remained there, having travelled from the Cape to the Zambesi, Portuguese Africa, and then to the Equator and Congo. In all these countries this particular plant was seen in isolated parts, but not cultivated. Nobody knew of its value, only that the silky cotton could be used like kapok for stuffing furniture, and would not pay to export. This is merely mentioned to show that it can adapt itself to various climates, although indigenous to the Congo, Uganda, and Abyssinia. While at Uganda, planting rubber at the head of the Nile on the Victoria Nyansa, I wanted some rope for a line, and requested a native to get some, thinking he would get the bast of a banana. Much to my surprise the boy started pulling this particular plant, and drawing the fibre, then twisting it into rope of remarkable strength. I then forwarded samples of rope, fibre and botanical specimen to the Imperial Institute, London, with the result that the plant was identified as *Asclepias semilunata*, and the fibre, if properly prepared, was valued, on the London market, at £35 per ton. The examination of samples sent from Uganda has shown that it is very strong and of excellent quality, and would doubtless be used for cordage manufacture, but it has not yet been exported in sufficient quantities for actual trials on a manufacturing scale. It is possible that the fibre might also be utilised for the manufacture of explosives, but this question is at present under investigation. I sent a sample of the fibre and a quantity of seed to the Hon. John Perry, M.P., to test if it can be successfully grown in New South Wales. I feel confident that it can be profitaly grown, as its geographical distribution is so well known to me; I have seen it at an elevation of 7,000 ft. above sea-level at Johannesburg; also at Rhodesia, and in Australia; but have not seen it near the coast, though it may succeed near the sea. The cultivation of *A. semilunata* is simple: sow as you would wheat or oats, after the land has been harrowed; seed thickly, so as to produce stems 5 ft. to 6 ft. long. It will grow on stony land, on the flat or hill-sides; it requires no irrigation, and will withstand drought with impunity. With cheap freight from Sydney to London, let alone local market, this fibre may prove to be a desirable subsidiary industry for New South Wales. The writer, who is an Australian, thinks that the seed must at some time have been introduced into Australia by the late Baron von Mueller, otherwise it is a mystery how he saw it at Coolgardie. The writer trusts that through the columns of the *Agricultural Gazette* more will be heard from tests in New South Wales.

The sample of fibre forwarded to the Hon. the Minister for Agriculture was submitted to Messrs. Forsyth and Co., rope manufacturers, Sydney, who reported as follows: "The fibre is equal to manila, and is valued at £35 per ton. The length and colour are good. They would give £35 per ton for it, but the fibre must not be less than 4 ft. long. The quantity submitted was too small to make a test."

DRUGS AND MEDICINAL PLANTS.

TOBACCO CULTIVATION IN CUBA.

(From the *Agricultural News*, Vol. VIII., No. 183, May 1, 1909.)

The methods of raising tobacco, and the prices paid for labour on tobacco estates in Cuba, have been investigated by the United States Consul at Havana, and are reported upon in detail in the *Consular and Trade Reports* for February last, issued from Washington.

The chief tobacco-growing districts of Cuba are in the provinces of Havana and Pinar del Rio, and it is here that the best quality leaf is grown. Of late years the cost of production has largely increased, owing to the greater demand for labour in connexion with other industries.

The Consul takes as the basis of his estimate an area equal to an English acre, and gives the details of expenditure necessary to produce the tobacco from the young plant to the leaf in bale, both when sun-grown, and when raised under shade provided by cheese cloth.

By far the greater part of the Cuban tobacco is raised in the open without shade of any kind. Generally speaking, the shade-grown tobacco is for wrappers of cigars, and that raised in the open (the less expensive process) serves for filler purposes.

The following statement of expense is given for producing an acre of tobacco in the open :—

Sun-grown (open) Tobacco.

Ploughi g, 20 days ' wages at $1·20 ..	$24·00
Planting, 10 ,, ,, ,, ,, ...	12·00
Supplying, 3 ,, ,, ,, ,, ...	3·60
Hoeing (3 times) 21 days ' ,, ,, ...	25·20
Other cultivation expenses (estimated), such as topping, pulling off suckers, etc. ..	15·00
Gathering crop, 15 days ' wages at $1·20	18·00
Labour in curing house (perhaps 2 days ' wages)	3·00
Packing labour (unskilled) 8 bales at $6·00	48·00
Total, Spanish currency ...	$148·80
Total, American currency ...	$129·40

In order to reduce the Spanish figures to their equivalent in American currency, it is necessary to make a deduction of about 13 per cent. It will be seen, therefore, that the average price given for labour on the Cuban tobacco plantations amounts to about $1·05 per day. This labour must be regarded as more or less skilled. The sum of $24·00 (Spanish) for ploughing an acre of land may seem an expensive item, but it should be pointed out that under this heading are really included all the operations of cultivation, and it may really involve several ploughings of the land, which is thoroughly prepared before planting.

The expenses of growing the crop under shade are far greater, and are placed at an average of $328·20 per acre. When shade is provided, a somewhat higher yield is usually obtained—about 10 bales per acre, and the value of the product is, of course, considerably greater. The figures which have been quoted do not represent the total cost of production. In addition to the items enumerated, the cost of supervision, depreciation of plant and implements, etc., must be taken into account. It is mentioned that the total time occupied in the production of tobacco from seed to bale is about six months. The average price realized per bale 150 lb.) of Cuban tobacco is not far from $60, and the best qualities command prices of from $70 to nearly $100 per bale. On the whole, therefore, the industry would appear to be highly profitable.

DEVELOPMENT OF THE TOBACCO INDUSTRY.

(From the *Journal of Agriculture*, Victoria, Vol. VII., Part 5, May, 1909.)

The following figures in relation to the tobacco industry show the progress made since Mr. Temple A. J. Smith was appointed Tobacco Expert in 1901 :—

Season.	Number of Growers.	Acreage.	Produce of Tobacco Dried Leaf in cwts
1901-02 ...	17	103	345
1902-03 ...	24	171	781
1903-04 ...	25	129	848
1904-05 ...	20	106	1,112
1905-06 ...	31	169	1,405
1906-07 ...	30	133	603
1907-08 ...	49	345	1,767

It will be noted that the number of growers, and also the area under cultivation, has been trebled, and that the yield has increased in still greater proportion. The low yield of 1906-7 was due to the exceptionally bad season. For the present season, 1908-9, the area prepared for the crop considerably exceeds any of those quoted.

One of the most pleasing features of the development of the industry is the fact that Victoria can and does produce a good quality cigar leaf, although it was predicted by several manufacturers that it would be impossible to grow cigar leaf under prevailing climatic conditions. Another proof that Victorian leaf is improving in quality is shown by the increased prices obtainable. The pipe tobaccos now sell at 7*d.* to 9*d.* per lb., while for cigar leaf 1*s.* to 1*s.* 6*d.* has been obtained, and, in one instance, 2*s.* per lb.

The foregoing figures will give some idea of the crop to producers. Crops of 1,000 lbs. to 1,500 lbs. of cured leaf per acre are not uncommon, the value at present prices being from £30 to £40 for pipe tobaccos, and as high as £100 per acre for cigar leaf.

EDIBLE PRODUCTS.

THE TREE TOMATO.

By H. F. MACMILLAN.

Cyphomandra betacea (N. O. Solanaceæ): "Tree Tomato"; "Gas-takkali," Sinh.—An evergreen semi-woody shrub, native of Peru, and introduced to Ceylon through Hakgala Gardens in 1882. It has become thoroughly established in many hill gardens, and is commonly grown about Nuwara Eliya for market. The egg-shaped and smooth-skinned fruit, produced in great abundance and hanging in clusters at the ends of the branches, is in season almost throughout the year, but chiefly from March to May. At first greenish purple, it changes in ripening to reddish yellow. Some varieties are of a deep purple colour. The sub-acid succulent fruits are refreshing and agreeable when eaten raw, but their chief use is for stewing; they may also be made into jam or a preserve. The tree is a quick grower, and commences to bear fruit when two or three years old, remaining productive for several years. Propagated from seed.

THE TRANSPLANTING OF RICE IN CHHATTISGARH.

By D. CLOUSTON, M.A., B.Sc.,
Director of Agriculture, Central Provinces.

(From the *Agricultural Journal of India*, Vol. III., Part 4, October, 1908.)

In the year 1906 there were 4,259,826 acres of rice in the Central Provinces and 28,027 acres in Berar, or a total area of 4,287,853 acres for these Provinces. Of this area 754,342 acres were transplanted and 3,533,511 acres broadcasted. Of the transplanted area 365,047 acres were irrigated, and 389,295 acres unirrigated. The chief rice-growing districts are Chanda, Bhandara and Balaghat in the Nagpur Division, and Raipur, Bilaspur and Drug in Chhattisgarh. In the Nagpur Division 68·4 per cent. of the total area under rice is transplanted; in Chhattisgarh with 2,830,074 acres, 37,873 acres or only 1·3 per cent. are transplanted, and even this small area is confined to tracts bordering on the districts where transplanting is already in vogue. It is difficult to account satisfactorily for this important difference in agricultural practice between these two tracts, which are situated at no very great distance from each other, and between which there is a good deal of inter-communication. Whilst the Wainganga valley districts consist of soil of crystalline formation, Chhattisgarh soil is mostly of laterite origin, but both seem equally suitable for transplanted rice. Want of knowledge or difference in the habits of the population can hardly account for the distinction. The most likely reason is that Chhattisgarh has hitherto had few facilities for irrigation, which is of more importance to transplanted than to broadcasted rice; but this difference is rapidly disappearing with the construction of irrigation works in Chhattisgarh. Chhattisgarh is the most backward agricultural tract in these provinces, and the Chhattisgarh is recognised as one of the laziest and least enterprising of cultivators. A large proportion of them are charmers by caste. As a race they are strong and hardy, make good farm servants if properly managed, but are quarrelsome and are much given to agrarian disputes.

The soils of this division are mostly of laterite origin. They may be divided into four distinct classes. The partially decomposed laterite rock of the higher lands, which gives a reddish gravelly soil, locally known as *bhata*, is the typical soil of large high-lying ridges covered with scrub and stunted grass, some of which bear at intervals a poor crop of the lesser millets (*Paspalum scrobiculatum* and *Panicum psillopodium*). The *bhata* grades gradually into *matasi*, a fine-grained yellow loam which is considered the ideal soil for paddy in this tract. *Matasi* like *bhata* is unsuitable for double-cropping on account of its tendency to harden after the rains into a brick-like mass, which it is almost impossible to reduce to a fine state of tilth by means of the cultural implements in use in this tract. Moreover, it does not retain moisture well. Dorsa, or *dorasa* (meaning two kinds), is a mixture of *matasi* and *kanhar*; it is dark grey in colour, grows rice and rabi crops fairly well, and is therefore suitable for double-cropping. *Kanhar* is a dark loamy soil found at still lower levels; it contains less sand, and if pure, no nodules of limestone; it is very retentive of moisture. *Kanhar* is the best wheat-producing soil of the tract, but is not

Photo by H. F. Macmillan.

THE TREE TOMATO.

(Cyphomandra betacea.)

so good for rice, being too heavy. Dr. Leather's analysis ot these soils is given below :—

	Matasi.	Dorsa soil.	Kanhar soil.
Insoluble silicates and sand	84·41	74·68	69·73
Ferric oxide	4·12	8·71	7·64
Alumina	4·78	11·43	13·83
Lime	0·28	0·85	1·05
Magnesia	0·30	0·81	0·75
Potash	0 43	0·86	0·79
Soda	0·13	0·20	0·25
Phosphoric acid ..	0·02	0·12	0·02
Sulphuric acid ..	very little.		
Carbonic acid... ...	0·13	0·09	0·08
Organic matter and combined water ...	2·40	4·35	5·86
	100·00	100·00	10·00
Total Nitrogen... ...	·053	·041	·036
Available phosphoric acid	·001	·001	·001
Do do. potash	·010	·011	·012
Equivalent to calcium carbonate ...	·30	·20	·10

The Raipur Experimental Farm is fairly representative of this grading of soils, ranging from *bhata* on the higher land outside the farm limits to the gently sloping fields of *matasi, dorsa* and *kanhar* of the farm itself. The *matasi* area is reserved solely for rice; the *dorsa* for rice followed by pulses, or wheat as the sole crop of the year, and the *kanhar* for wheat and sugarcane. The farm was established mainly with the view of solving problems relating to the cultivation of rice, the staple crop of the tract. One of the problems was to find the best method of sowing and after-cultivation. The methods practised in these provinces are transplanting, *biasi*, broadcasting and *lehi*. As practised in the Raipur Farm transplanting is carried out as follows :— High lying plots, where water does not collect, are selected as seed-beds, the whole rice area being divided up into one-tenth acre plots which are embanked with bunds 1½ feet high. The bunds were constructed five years ago, and have so far required very little repairs. The area of the plots selected for seed-beds is one-tenth that of the area to be transplanted. The seed-beds are ploughed by the country plough, soon after the removal of the previous year's crop, when the soil is moist after the winter showers. The plots are then twice harrowed in April or May, manured with cattle dung at the rate of about 5 tons to the acre in June, and again harrowed after the first shower of the rains. Seed is broadcasted at the rate of 200 lbs. per acre. The seed may be sown before the outbreak of the rains if the land is sufficiently free from weeds. The seedlings are ready in from three to four weeks, the time depending largely on the quantity and quality of the manure used. The plots to which the seedlings are to be transplanted are ploughed once in the dry weather. In the beginning of the rains when the soil is sufficiently saturated with moisture, the plots are again ploughed and cross-ploughed by the country plough, and finally puddled by means of the *dotari*, *i.e.*, a 6-feet beam fitted with harrow teeth. If the field is uneven, mud is dragged down from the higher to the lower ground by means of the same implement turned upside down, and then called a *kopar* or *mai*.

Buffaloes are mostly used for rice cultivation, because they are stronger than bullocks and take kindly to wet work of this kind. In Chhattisgarh no nose strings are used for working cattle, but by a dexterous use of the goad, and cries of ar-r-r-r, hra-ha-ha-ha, etc., which to the uninitiated are meaningless enough, the ploughman manipulates his animals with considerable skill within the small area circumscribed by the bunds of the rice plots. When the soil of the plot has all been reduced to a creamy consistency (of wet mud), the plot is considered ready for transplanting. The seedlings, which are, when ready for transplantation, about one foot high, are uprooted, the worker resting on one knee in the muddy water while doing so. Each handful is tied into a small bundle and placed on a *khirri* or sledge, which is dragged to the plots in which the seedlings are to be transplanted. The *khirri* is so shaped so as to run easily over the rice bunds.

The bundles are scattered equally over the plot to be transplanted so as to be within easy reach of the labourers as they move backwards. The root and lower part of the stem of each seedling is pushed into the soft mud to a depth of one or two inches and at distances of six or nine inches apart. The plants take root in a week, at the end of which time blanks are filled up. By planting only one seedling to the hole the seed rate is about 20 lbs. per acre. At this rate the seed-bed will suffice to transplant ten times its own area. In some districts where transplanting is widely practised, the seedlings are planted out in bunches containing from two to five plants, and the seed rate per acre is 80 lbs. One seedling per hole is the standard adopted both on the Experimental and Demonstration Farms. One woman can transplant one-tenth acre in one day of ten hours when seedlings are brought to her. In most parts of Bhandara and Balaghat the method of trans-

planting is different, the bunches of seedlings being simply thrown into the mud while the worker moves backward. The time spent in pushing the seedlings into the mud is thus saved, and the work is done much faster. This method, however, is open to objection. The seedlings not being fixed in the mud, it sometimes happens that they are washed away by a heavy rain before they have time to take root. A long break in the rains just after transplanting may prove equally injurious, many of the young plants being killed by the drought before they have time to take firm root. The method now being introduced into the Chhattisgarh is open to neither of these objections and is practised by the very best rice-growers in the best rice districts. It requires more time, but reduces to a minimum the risk of injury to the young seedlings from too much or too little water. As a protection from the rains many of the workers wear a large *topi* made of leaves.

Of transplanting in Balaghat where rice cultivation is more skillfully carried out than anywhere else in the Central Provinces, Mr. C. E. Low, I.C.S., Deputy Commissioner, writes: –"Transplanting is the system usually pursued; it is said to give a larger outturn and grain of superior quality of flavour, and to be indispensable for the best kinds of rice. Broadcasting is usually practised in black soil where transplanting is more difficult than in light soil, and where early ripening varieties are sown to enable a second crop to be reaped. It is also adopted when a season of short rainfall is feared, or when the skill or resources of the tenants are not equal to transplantation; this is often the case with aboriginal cultivators in jungly tracts. For transplanting, the nursery is sown by the usual method adopted for all Kharif crops. Before sowing it is cultivated twice with a *nagar* or narrow-bladed plough. A scarifier or *bakhar* is not used in light soil till a plough has twice been over the ground, so that the scarifier is not used for rice nurseries unless the land has been already ploughed up by the plough in the cold or hot weather. The manure consists of cow-dung, and before the application of this, straw, and, near the jungle, twigs and branches often spread over the nursery and burned. (*Saj Terminalia tomentosa* is the favourite tree for this.) When the rain falls, this is ploughed into the ground, and the *datari* or harrow worked over the land to break up the clods. Seven or eight cartloads per half acre of nursery is considered a full manuring. Malgusars with a large home-farm have to start their manuring a month or so before the rains break. Manure is not always, or even usually, given to any part of the field besides the nursery. For transplanting the seed rate is about 85 lbs. per acre. A transplanted field can be easily told even after reaping, as the plants tiller far more than if sown broadcast, and the ground is more free from weeds. The nursery, after ploughing, manuring and clod-crushing is completed, is cleaned of weeds by women with sickles. The seedlings in 20 or 25 days grow to a foot in height, when they are fit for transplanting. Meantime the remaining area is ploughed again and left for a week. The (*datari*) harrow is used to break up clods, for which purpose it is turned upside down. The plough and the harrow are used twice each, by which time the surface consists of a smooth and creamy mud. Heavy rain just before transplantation spoils the consistency of the mud, and it has to be ploughed up again. The seedlings are uprooted from the nursery and stuck into the mud in bunches of about three or five; they lie flat for a day or two and then stand upright, except where there is very high rainfall, when they lie and rot: *garakha gaye* (the mud has eaten it) says the unfortunate cultivator. The crop later in the season looks miserably stunted and is scarcely in ears; while surrounding fields contain a full crop. The seedlings are carried in head-loads in the case of small tenants, but on a *khirri* or sledge drawn by buffaloes, where cultivation is more extensive. If things go well, the transplanting for the districts should be over in a month. The daily wages for transplantation are said to have risen from one anna before the 1896 famine to 1½ anna in 1905. The above methods, which in the best villages are conjoined with very careful seed selection, are not susceptible of much improvement. It is, however, likely that the seed rate could be considerably lowered, if the area outside the nursery were well manured and the seedlings were transplanted singly, instead of three to five at a time. The seed rate on the Government farms where this is done is less than half that described above."

Biasi is the method widely practised in Chhattisgarh. The land is ploughed once before sowing. The seed is broadcasted at the rate of about 100 lbs. per acre. When the plants are about one foot high the land is ploughed, which uproots many of the plants and covers some with mud.

This rough-and-ready process thins out the plants and strengthens the root-

growth of those that are left. Five or six days later the plot is levelled by means of the *kopar*, which flattens all the surviving plants in the mud. In five or six days more weeding operations are commenced; two or three weedings at intervals of about a fortnight are generally necessary.

Broadcasting is the easiest and cheapest of all the methods in vogue. It is similar to *biasi*, but the seed is allowed to grow as it is sown; there is no thinning out of the plants. In its crudest form as practised in some of the Native States in Chhattisgarh, the land is ploughed at the beginning of the rains, the seed sown broadcast and covered by means of the *kopar*, and the crop is left untouched till it is ready for harvesting. As a broadcasted field ripens earlier than a transplanted one, broadcasting is generally practised in high-lying fields which are less retentive of moisture, and where, for that reason, the earlier maturing rices only can be grown. This method is an alternative to transplanting in Bhandara and Balaghat.

By the *lehi* or *koorah* method the seed is steeped before sowing so as to hasten germination; otherwise, the method is the same as broadcasting. This method is practised in the Nagpur Division and parts of Chhattisgarh, and to the greatest extent in years in which the sowing has been delayed by heavy and continuous rain. In Jubbulpore and Damoh under the name of *Machhawa*, it is the method commonly followed in the best rice soils. On the Raipur Farm these four methods are being tested in series A and B of the experimental programme, A being irrigated and B unirrigated. Both series of plots are uniformly manured with cattledung at the rate of 20 lbs. of nitrogen per acre; the soil of the two series is *matasi*. The plots are each one-tenth of an acre in area. The paddy grown is *Pareiva*, a medium variety. The results obtained are given in the statements following:—

UNIRRIGATED:—OUTTURN PER ACRE IN LBS.

Plot.	1904-05.			1905-06.			1906-07.		
	Grain.	Straw.	Value.	Grain.	Straw.	Value.	Grain.	Straw.	Value.
			Rs.			Rs.			Rs.
I. Transplanted...	1,940	1,440	49	1,630	1,050	48	1,840	1,340	41
II. Biasi ...	1,450	1,000	36	430	340	13	1,600	1,240	39
III. Broadcasted ...	750	640	19	740	580	22	1,240	690	29
IV. Lehi ...	930	1,010	24	470	410	14	790	570	19

Plot.	UNIRRIGATED:—OUTTURN PER ACRE IN LBS. 1907-08.			Average value of Outturn.	Cost of Cultivation, Manure, &c.	Average profit, loss due to each method.
	Grain.	Straw.	Value.			
			Rs.	Rs. A.	Rs. A.	Rs. A.
I. Transplanted	1,080	1,130	46	46 0	8 14	37 2
II. Biasi	710	780	30	29 8	10 2	19 6
III. Broadcastd	750	890	32	25 8	6 14	18 10
IV. Lehi	270	280	11	17 0	10 7	6 9

IRRIGATED:—OUTTURN PER ACRE IN LBS.

Plot.	1904-05.			1905-6.			1906-7.		
	Grain.	Straw.	Value.	Grain.	Straw.	Value.	Grain.	Straw.	Value.
			Rs.			Rs.			Rs.
I. Transplanted...	2,000	1,560	47	1,940	1,220	54	1,940	1,430	47
II. Biasi ...	1,670	1,070	40	1,610	1,160	49	1,240	1,150	30
III. Broadcasted ..	960	700	24	1,190	970	36	1,220	1,410	31
IV. Lehi ...	770	1,270	22	1,120	860	34	730	690	17

Plot.	Irrigated :—Outturn per Acre in lbs. 1907-08. Grain.	Straw.	Value.	Average value from 1904-07.	Cost of Cultivation, Manure and Irrigation.	Average profit, loss due to each method.
			Rs.	Rs. A.	Rs. A.	Rs. A.
I. Transplanted	1,550	1,480	66	54 8	10 12	43 12
II. Biasi	1,140	1,120	48	41 12	12 0	29 12
III. Broadcasted	1,120	1,180	48	34 12	8 12	26 0
IV. Lehi	980	970	41	28 8	12 5	16 3

Transplanting without irrigation has increased the value of the yield by Rs. 17·12 per acre. Irrigation alone has raised the value of the yield by Rs. 10·6, even with *biasi*. When transplanting and irrigation are carried out together, the monetary value of the increase when compared with the Chhattisgarh method of *biasi* sowing without irrigation is Rs. 24·6 per acre.

The conclusion in brief to be drawn from these results as far as they apply to this division are: (1) that transplanting is a most profitable method even without irrigation where medium paddy is grown; (2) if the Chhattisgarh will but irrigate his *biasi* paddy, he can improve the value of his crop by over Rs. 10·6 per acre; and (3) by adopting transplanting with irrigation, he can increase his profits by Rs. 24·6 per acre.

(To be continued.)

THE TEA INDUSTRY.

Some Modern Developments.

(From the *Indian Agriculturist*, Vol. XXXIV., No. 2, February, 1909.)

The advent of science in the tea industry is rapidly inaugurating new methods and new ideas, and where, not so very many years ago, the planting of tea was carried on in old-fashioned and rule-of-thumb methods, we have now a Scientific Department devoted to the promulgation of principles advocated by the best schools of agricultural practice in England and America. In this connection it is interesting to review some of the changes that have to be recorded in the application of these principles to the culture of the tea plant and the manufacture of the product itself.

The Soil.

To take the question of the growing medium, the soil, the planter of to-day not only understands its physical texture and the functions of the different chemical ingredients which go to make up its bulk, but he grasps the significance of manurial possibilities, and endeavours to compensate for deficiencies by the studied application of organic and inorganic matter to suit his purposes. The old days when hoeing either deep or light expressed practically all that the word cultivation held for the planters has gone, and cultivation in its truest and best sense is now part and parcel of the enterprising assistant's conversation. The effect of water on the soil, of heat, and the effects of draining and the manipulation of the soil is discussed with a grasp of the subject that is worthy of a student of the Rothamstead Agricultural College. Manuring is no longer limited to line sweepings and bheel soil, but on all sides we see experiments being carried out with artificial manures and the different means by which organic matter can be added to the soil to increase the humus, while the question of the introduction of nitrogenous trees and shrubs is universal. The conservancy of cow-dung manure by the advice of the Scientific Department and the dissemination of the recommendations of agricultural chemists like Hall and King is reaching a fine art, and the more up-to-date gardens have, dotted throughout their coolie lines, pucca manure pits, brick-lined and covered with corrugated iron or thatched roofs. In many gardens it is the custom to mix with the manure, collected daily from the lines, cut jungle which, in layers with the manure, forms a compost at the end of a season invaluable as a fertilising agent.

The Application of Manure.

Not only is the question of the actual manures themselves receiving assiduous attention, but the method of application is constantly undergoing observation and experiment. It was too long the custom to apply manures loosely on the surface of the soil, but the experiments which have been carried out at the Heeleaka Experimental Station, chiefly by Mr. Hutchinson, have proved so conclusively that manures in this way are

wasted to a certain extent, that they are now buried in trenches with a view to inducing greater vertical depth of roots.

Perhaps one of the most notable features of manuring in the Tea Districts has been the increase in the use of oil-cakes; and the discovery that homœopathic doses of these give practically the same results that large doses do, has led, and will continue to lead, to their general application.

But the most striking of all manurial innovations in the tea districts is the extension and use of green manuring both as a means of adding organic matter to the soil and because of the faculty which the family of leguminous plants enjoy of drawing nitrogen from the air and the parting with the same to the soil in a form that the plant can assimilate. Here, indeed, it is not too much to say that the whole face of the tea districts has been changed, and there are few gardens which have not their area of land planted with nitrogenous crops every year. A writer of distinction declared in an article which he wrote for the *Statesman* some little time ago on Green Manuring that every garden should be able to do at least a sixth of its acreage every year with some nitrogenous crop. To those who are in straits for labour this estimate may appear out of the question, but if it is an over estimate it at least represents a degree of excellence worth striving for. Indeed, it is unreasonable to aver that sooner than neglect the planting up of at least a sixth of the area of a garden with a nitrogenous plant, it would be better to sacrifice some other work which might at first sight appear to be more productive of immediate return.

BENEFITS OF DRAINING.

To return from manuring to draining: it is now recognised by the majority of tea planters that whereas many stretches of land were considered to be so-called self-drained these are now realised to be very much in need of this operation. It is no longer the desire of the modern planter to get rid of water as it falls from the heavens, but to induce that water, instead of passing over the face of the earth, to soak into the soil, taking with it the air and the mineral substances with their life-giving properties. The improvement by drainage may be summed up in an improved texture of the soil which makes it more friable and more easily worked, with the result that when the level of the water in the rainy season is lowered it allows the roots to penetrate deeper so that they have a wider range of feeding ground. Not only is this latter of immense benefit towards the greater growing condition of the roots, but it prevents the effects of drought, as the roots become independent of surface conditions and get enough capillary water to keep them going. The damage from drought which results to tea gardens in many districts annually is too well-known to be written of here, and there is nothing that counteracts a drought to the same extent as thorough and deep draining. Another great benefit which accrues from the removal of excess water from the neighbourhood of the roots is that the sun's heat reaches the soil without wastage and the air and water get the opportunity of carrying the surface temperature downwards. As McConnell points out, water is a poor conductor of heat, and, therefore, the warmth of the sun's rays is carried very slowly into the soil when it is wet. If drained, the ordinary action of conduction will warm up the particles of soil much more quickly. There may be a difference of from 5 to 10 degrees Fahr. in temperature between drained and undrained soil, simply from the presence or absence of excess of water. The effect draining has with regard to blights is one of the other points which must not be lost sight of in tea, and flushing capabilities are enormously increased, first from the moist heat, and secondly from the absence of these blights. To continue the advantage of drainage, soil wash is to a great extent prevented, as the rain water is permitted to percolate downwards, whereas if the soil was already wet, the inclination is for it to run over the surface, carrying with it the finer particles of the soil. Again, draining is imperative before we can get the full benefit of manurial dressings we apply to the soil, as only in this way can those which have been applied to the surface be carried down to the roots. As a result of the improved texture of the soil above mentioned, the better capillarity, oxidation, and action of manures, the tea bush flourishes as it never would in a cold undrained soil, be the natural drainage what it may. But the improvement which results from drainage is so immense and so extensive in its character that space forbids dealing with it further.

What science has done for the actual soil conditions in conection with the tea plant has here been roughly outlined, and the progress which has been made in other directions and which are as drastic and of as much importance will be dealt with later.

If the knowledge of what constitutes the principal ingredients of the soil and their various functions and also the

question of the improvement of the soil as a growing medium are characteristic of the interest displayed by intelligent planters of to-day, the same may be said with regard to the botany of the tea bush itself. To the casual observer the tea bush or any other kind of bush in existence consists of a vegetable item of which the greater part, and certainly the more important part, appears above ground, is entirely and wholly visible to the eye, and has the faculty of producing for the use of mankind certain edible products which are valued in a greater or less degree. It has been recognised by men who have spent the greater part of their lives growing edible products for their fellows, that plants of different descriptions have a tendency to give larger quantities of their individual products after subjection to special treatment. It has been found that by manuring the soil the actual bush or shrub which appears above ground gives a more pronounced growth, or in some cases a crop of finer quality, and it has also been discovered that a certain amount of judicious curtailment of the growing part of a bush will result in a great production of fruit or flowers or leaves. The study of these questions has led to the foundation of the arts of horticulture and arboriculture and various other agricultural systems applied to the production of flowers in the one case and timber or leaves in another, and fruit in a third. Now these arts have been so developed in course of time that the horticulturist has been enabled to stunt the growing parts of any individual bush in whatever direction he pleases, to induce it to grow that which he specially requires. Not only does he find that by judicious pruning a bush can be forced into channels other than those which nature has laid down for it, but also that by skillful application of different manurial ingredients he can stimulate the bush in such a way that either quantity or quality is the result, as the case may be. More, it has been found that different kinds of cultivation are applicable to different kinds of fruits and flowers and trees, and the gardener or the arboriculturist cultivates his stock-in-trade for the different purposes accordingly.

As the process of evolution applied to forestry and market gardening has widened and developed, the planter has worked along similar lines, and in the treatment of the tea bush, both below ground and above, he exercises that skill, which comes after years of experience, in inducing the greatest growth that is compatible with the continued well-being of the tea bush.

The Roots of the Tea Bush.

Root development is a question that is closely associated with that of cultivation, and while the planter still exists who pins his faith to cultivation as a surface operation and to mere plucking and pruning as another, the man who is selected for the better charges considers underground growth of his bush in conjunction with its functions, and views all operations above ground as dependent upon the conditions underneath. It should be palpable to the veriest tyro that before healthy growing conditions can be established above the surface the feeding arrangements of the plant below the ground must be healthy and vigorous, but this very point is one that is apt to be lost sight of when the great cry is profits, and profits at any cost. The tendency to consider the surface part of a bush as the most important is very great when it is remembered that all the profits are apparently made from the surface part only. Old traditions die hard, but when intellect points to what is sound and commercially satisfactory in the long run, the needs of the present become more and more sacrificed to prospects of the future, with the result that the permanency of the bush receives proper attention at the hands of the planter. We have always had the keenest scrutiny of the framework of the bush from the representatives of Calcutta Houses who have visited the Tea Districts, and while it is quite true that much of the history of what is going on beneath is obvious from surface conditions, that is no reason why the roots should not receive the same careful examination as the branches of a plant.

The planter of to-day works for a spread and depth of roots, encouraged by artificial means if necessary, that will give him better branches and a more vigorous flow of sap. Given roots in a healthy condition, clean, straight, healthy stems are bound to follow, and with a framework, massive and clean, once established, it is the planters' care to retain it in that condition.

Pruning.

We here come to the question of pruning, and it is no exaggeration to say that since the establishment of the Scientific Department the whole system of pruning the tea bush has been revolutionised. Pruning was at one time an operation that consisted in the cutting of a bush straight across from a point in the centre, which was decided by the position of the previous year's pruning. This process was continued year by year until the bush became so high that

it was unwieldy, and hard to pluck. That point having arrived, the usual decision was to cut the bush back, sometimes as much as two feet, and then begin the process again. A more simple process could not very well be imagined, and since it required not very much intelligence and no great amount of experience, it had its advantages in its day. But the tea bush is grown as a commercial enterprise after all, and there can be very little doubt that the old system of pruning could not possibly prove for long a success. A point was reached sooner or later when it was imposible to cut the bush back again, as no clean wood was left to cut back upon, and when the cut was made in the centre of a mass of knotty wood and a temporary return to vigour was established the bush became, as it was bound to do, more and more impoverished, with the inevitable result that deterioration set in and the yield gradually decreased. With the bush at that stage of its existence—a gnarled and twisted mass of re-grown wood from collar to tip—some more than usually smart planter, with some glimmering of horticultural science, cut his bushes across at the collar where no knife had ever entered before, and behold, a new bush with clean straight wood and the world before it again. No sooner was this system of collar pruning instituted, than it was hailed as a panacea for all deteriorated tea, and hundreds and hundreds of acres were treated to this severe knifing process throughout Assam and other Tea Districts. The result of collar pruning was successful more or less, but its success depended to such an extent on climatic conditions, soil and the treatment of the bush after the operation, that at last it became evident that the process was as often a failure as a success. At this point the Scientific Department stepped in, and, after a thorough examination of tea-planting methods, it practically condemned the whole system of pruning in vogue, not necessarily as a system but more in its method of application. It was averred by the Scientific Department that systems of pruning and plucking were rapidly reducing all tea bushes in yield year by year, and while it was seen that pruning was a process which had to be preserved in, suggestions were made for its modification along scientific lines, which it was hoped would lead to the same, if not better, results as regards yield, while at the same time it would ensure the permanent life and vigour of the plant. It was also recognised that whereas collar pruning practically rejuvenated a plant that had been badly treated for many years, the invigoration of such a plant depended so enormously upon the quality of the soil, the climate, and its subsequent treatment that collar pruning could by no means be recommended as a cure for deterioration.

The Scientific Department has gone into the whole question very fully, and there is no need to labour the question any further in this article. It is sufficient to say that a bush is now pruned upon scientific laws to induce it to give the maximum amount of leaves without detracting from its eventual well-being.

SIRDAR.

MEMORANDUM ON THE CULTIVATION AND PREPARATION OF GINGER.

(From the *Imperial Institute.*)

Ginger is the underground stem (rhizome) of the plant known botanically as *Zingiber officinale*, indigenous to the East Indies, but now cultivated in many tropical countries, such as the West and East Indies, West Africa and Queensland.

CULTIVATION.—Two methods of cultivation are adopted. That by which the best ginger is obtained consists in planting in March or April (in Jamica) portions of seclected rhizomes from the previous year's crop, care being taken that each portion of rhizome planted contains an "eye" (embryo stem). These portions of rhizome are placed a few inches below the surface of the prepared soil and about one foot apart, the process being much the same as that observed in planting potatoes. It is advisable to thoroughly clear the land of weeds before the sowing of the rhizomes is done, as otherwise the removal of weeds becomes difficult later on when the ginger plants have developed. Unless the rainfall is good, it is necessary to resort to irrigation as the plants require a good supply of water. The ginger produced in the foregoing way is known as "plant ginger."

"Ratoon ginger" is obtained by leaving in the soil from year to year a portion of a "hand," *i.e.*, roots and a portion of a rhizome containing an "eye." This "eye" develops in the normal way, giving rise to a supply of rhizome in the succeeding season. "Ratoon ginger" is smaller and contains more fibre than "plant ginger," and the product obtained by this means is said to deteriorate steadily from year to year.

The foregoing relates mainly to the cultivation of ginger as followed in Jamica. The plan adopted in Cochin (India) differs from it but little. In the latter

country the land is ploughed two or three times before the rhizomes are planted, and these are usually placed about 9 inches apart in parallel furrows 15 inches apart. The field is then covered over with the leaves of trees or other green manure to keep the soil moist, and over the leaves organic manure is spread to a depth of about half an inch. At the end of the rainy season it is necessary to resort to irrigation. During the first three months of the dry season the field is weeded about three times.

COLLECTION AND PREPARATION OF THE RHIZOMES.—"Ratoon ginger" is gathered from March to December, but "planted ginger" is not ready for digging until December or January, and from then until March is the ginger season. The rhizomes are known to be ready for digging when the stalk withers, this taking place shortly after the disappearance of the flowers. The plant flowers in September in Jamaica. The rhizomes are twisted out of the ground with a fork. In performing this operation great care is necessary, as any injury inflicted on the rhizomes depreciates their market value. Considerable experience is necessary in order to lift ginger rhizomes properly.

The "hands" (complete rhizomes and adherent fibrous roots) are piled in heaps, the fibrous roots are broken off, and the soil and dirt removed immediately, as otherwise it is difficult to get the finised ginger white. The roots should not be allowed to lie in heaps long as they are liable to ferment. The usual plan is, as soon as the roots and excess of soil have been removed, to throw the ginger into water to be ready for "peeling or scraping." This is done by means of a special knife consisting merely of a narrow straight blade riveted to a wooden handle. The operation of peeling is a very delicate one, the object being to remove the skin without destroying the cells immediately below it, since these cells contain much of the oil upon which the aroma of the best qualities of ginger depends. As fast as the roots are peeled they are thrown into water, and washed, and the more carefully the washing is done the whiter will be the resulting product. As a rule the peeled "hands" are allowed to remain in water overnight. Some planters in Jamaica add a small proportion of lime juice to the wash-water at this stage. After washing, the peeled rhizomes are placed in a "barbecue," which consists merely of a piece of levelled ground covered with cement, on which the ginger is placed to dry in the sun. Where a "barbecue" is not available a "mat," consisting of sticks driven into the ground across which are laid boards, palms or banana leaves on which the ginger is exposed until it is dry, is used. Careful planters put their ginger out daily at sunrise and take it in each night at sundown; conducted in the latter way the operation of drying takes from six to eight days.

The finished ginger is graded according to size and colour of the "hands," the best grades consisting of the large plump "hands" free from traces of mildew, and the poorest the shrivelled dark-coloured "hands." As a rule the crop is divided into four or five grades. The best "hands" obtained in Jamaica weigh as much as eight ounces, four ounces being an average weight.

Unpeeled ginger is merely freed from its rootlets and excess of soil and then thoroughly washed in water and finally dried in the sun. Much of the Cochin ginger is placed on the market in an unpeeled condition, but the best grades are peeled in the same fashion as in Jamaica and fetch similar prices in the United Kingdom.

SOIL AND MANURE.

Comparatively little attention has been paid to the nature of the soil best suited to ginger cultivation, and to the kind of manure which should be employed to fertilise soils exhausted by ginger crops. In Jamaica the primitive plan of clearing forest lands by fire has been largely followed, and on this cleared land ginger is grown until the soil becomes exhausted, when it is abandoned and a new piece of land put into cultivation. This wasteful method has resulted in the production of large tracts of exhausted land which are no longer under cultivation in the Colony, and the reclamation of which is still an unsolved problem. (See Kilmer, "Bulletin, Department of Agriculture, Jamaica," 1898, V., p. 241.)

In Cochin, on the other hand, manuring is regularly practised, the manures generally employed being oil-cake or dung. The principal constituents removed from the soil by ginger are stated to be lime, phosphoric acid and soda, and it is the replacement of these constituents which should be aimed at. The soil should be readily permeable by water, as if this collects about the rhizome, the latter is apt to rot. The best varieties of Jamaica ginger are grown on a sandy loam, and in India the ginger produced on the compact black soils is said to be poorer than that grown on the lighter sandy soils.

INDIAN AND CALIFORNIAN FRUIT.

(From the *Indian Agriculturist*, Vol. XXXIV., No. 5, May 1, 1909.)

Why should not India strive to do what California has done and make her oranges and citrons the desired of all nations? California has not succeeded without considerable sustained and intelligent effort in reaching the pre-eminence graphically described by a writer in a London journal. India owns thousands of orange trees, but their fruit is not precisely the delicious luxury that Californian and Southern European oranges prove to be. There is good Swadeshi work to be done in this direction if Indian fruit-growers can be induced to copy modern methods by experts educated in Indian agricultural colleges. We read of a golden harvest in California worth six millions sterling, from which in freight alone the railways earn two millions, the balance affording the orange farmers a handsome profit on their year's toil. The crop amounted to 1,500 million oranges, giving thus about 375 oranges to the pound sterling, a price that seems small enough when it is remembered that oranges sell now-a-days, all over England and elsewhere, at fabulously cheap rates. But the Californian growers' must feel content, for they cheerfully devote all their energies to the harvesting of their citrus crops, tens of thousands of persons being employed at them during the critical period. The United States alone consume 70 per cent. of the Californian oranges and 40 per cent. of the lemons. This year there cannot be quite the usual contingent of Sicilian oranges and lemons, but that will make little odds to America, for California, in spite of the taking up of land for town lots, parks, etc., has been bringing yearly more ground under citrus cultivation. Even the loss by the dying out and partial failure of old orchards has been provided against by industrious new planting. There are now in California about 100,000 acres under 10,000,000 orange trees and 20,000 under lemons. The fruit farmer who treats his land carefully can get a return of £100 to the acre, and if he grows the best of all species, the Washington Navel, he can even make £120; and lemons are as profitable but require intense care. Land that gives such colossal crops sells at £100 to £400 per acre. One district, Riverside, that was in olden days a sheeprun, is now, with its orange orchards, valued at four millions sterling.

In 1870 California made her first serious attempt at superior orange-growing. Until then railway facilities were scant, and the cultivation of the fruit round the stations of the Spanish Missions, which introduced it, was found sufficient for home wants and such other markets as could be reached. Los Angles was the pioneer exploiter of distant parts, by sending shipments to San Francisco, in barrels, boxes, sacks, in bulk, and in every way that seemed easiest to the haphazard trade of the time. The growers have now combined for the adoption of the best methods of treating the orange from the moment of planting and grafting to the despatch of the fruit to the buyer. The California Fruit-Growers' Exchange allows no diminution in the closest attention to prescribed rules and thus protects the cultivators and insures them a market for their fruit. Mexico has recently become a rival, sending grape-fruit, tangerines and other citrons to American markets, regardless of the half penny a pound tariff she has to pay. California has taken fright and has demanded protective measures to compensate her for this inroad, has applied to railways for reduction of freight charges, while she has tested the economy in time and money of taking the short cut to the Eastern markets offered by the isthmus of Tehuantepec. The packing of oranges is now-a-days by no means a simple process. The first duty of the packers, when the carefully picked fruit comes to them from the orchards in canvas bags, is to run the oranges through a hopper which removes any dust from them. Then after due rejection of all inferior specimens they are passed to the brushing-box where spiral brushes minutely perform their toilets. From the brushes they run on to belts that mechanically keep the produce of each grove separate and send the fruit on to a weighing machine. Thence they go to the sizers, where a belt carries them past springs which respond to the touch of each orange with an electric current that operates "kickers" which send the fruit into troughs according to size. Thence the oranges go to bins and are wrapped in paper by machinery, which includes a printing press that stamps the name of brand and packer on the wrapper. The last process is dropping the oranges into shallow bins whence they are placed in the packing-boxes of commerce, which are then automatically nailed up. Lemons require even more care, they are cut, not pulled, from the trees while green, and hung to ripen from the rafters of the packing-house where they are given ample time to colour before being shipped. An accidental bruise to their rind must be avoided, the packer

of lemons for this reason often wearing gloves. The citrus-growers of California got the better of the "Box Trust" by threatening to manufacture their own boxes, and forced a big reduction in price from the packing-case makers, amounting to an aggregate of £160,000, a very nice sum to hold in reserve in case of a falling market. Nagpur orange-growers might do worse than look up the system pursued by Californian owners of paying orange groves.

FURTHER NOTES ON CANE FARMING AT TRINIDAD.

BY PROFESSOR P. CARMODY, F.I.C., F.C.S.,

Government Analyst and Professor of Chemistry, Trinidad.

(From the *West Indian Bulletin*, Vol. IX., No. 2, 1908.)

During the last discussion which took place on this subject at the Agricultural Conference held in Trinidad in 1905 (*West Indian Bulletin*, Vol. VI., pp. 3-32), I promised to obtain some reliable figures as to the yield of canes per acre obtained by cane farmers in Trinidad. I am greatly indebted to Mr. J. McInroy, Manager of the Government estate (St. Augustine), for collecting the detailed yield obtained by 328 farmers on that estate, and thus enabling me to submit the following summary to this Conference:—

CANE FARMERS' CROPS (ST. AUGUSTINE).

	Tons.	Cwt.
Lowest yield per acre reaped ...	—	14
Highest ,, ,, ,, ...	29	12
Average ,, ,, ,, ...	11	14
,, ,, ,, rented ...	9	7
Number of cane farmers with yield under 5 tons per acre		49
,, ,, ,, ,, 5-10 ,, ,, ,,		116
,, ,, ,, ,, 10-15 ,, ,, ,,		99
,, ,, ,, ,, 15-20 ,, ,, ,,		47
,, ,, ,, over 20 ,, ,, ,,		17
Total ...		328

The average yield of the seventeen farmers producing over 20 tons was 24½ tons per acre.

It was stated at the Conference of 1905 that the average yield obtained by 399 farmers holding 1,753 acres was 5 tons per acre, the above figures show that 328 farmers produced, on land of no better quality, an average of 9 tons 7 cwt. on the acreage held, and 11 tons 14 cwt. on the acreage cultivated. In 1905, I estimated the average yield to be 10 tons per acre, which is shown by the above return to be very nearly correct.

The figures are of great value to us in Trinidad, because we can now confidently represent to our cane farmers that an average yield of only 11¾ tons per acre cultivated is far below what might reasonably be expected of them, and to our estate owners the manifest advantages of the share system of cane cultivation practised in Fiji, Hawaii, and Mauritius, and described by Sir Henry M. Jackson, K.C.M.G., in *West Indian Bulletin*. Vol. VI., pp. 18-21 and Vol. VII., pp. 311-6.

I am satisfied that it is on a co-operative system of production, such as this, that we must rely for the future stability of the sugar industry in Trinidad. Our central factories are well equipped for manufacture, and our principal weak point has been for many years in the cultivation. It is only quite recently that we have re-introduced mechanical implements for tillage, and these are almost confined to steam ploughs at present. The success of mechanical tillage in other countries, and the experience in this direction recently gained in the neighbouring colony of Antigua, should encourage us to adopt mechanical tillage to a much greater extent than has previously been attempted. And this can be done well under the share system of cultivation with its suitably balanced division of labour.

The heavy work of preparatory tillage should be done by mechanical implements, for which the cane farmer has not the capital to provide, in order, among other advantages, to ensure a sufficient feeding area for the roots. This is not available under the present method of hand tillage, and the result has been shown in the very small yield of 11 tons per acre. The lighter work of subsequent cultivation would be easily accomplished by hand labour provided by the farmers.

The estate owners would be better able to treat the cane tops before planting by immersion in Bordeaux mixture, or other similar preparation, which is now known to be necessary for the prevention of fungoid diseases. The cane farmers cannot, or will not do this, and their plots will become centres of infection from which these diseases will spread.

The estate owners would provide the manures shown by experience to produce the best results on their land. The cane farmer can only provide pen manure, and very little of that. He has neither the money to purchase artificial manures nor the knowledge to apply them to the best advantage.

The money advances now made by estate owners, presumably for the above purposes, would be of more advantage if the expenditure were made in the ways above indicated, under proper direction and supervision.

An enormous advantage under the share system is the continuous control which the owner retains during the whole period of the crop. The return for St. Augustine estates shows that only seventeen out of 323 farmers could be exempted from control under any good system of cane cultivation, and the timely assistance which the manager of an estate could give in order to bring neglected cultivations up to a reasonable standard would be certain to increase the productive capacity of the land, and to serve as a valuable object-lesson in the advantages to be derived from intelligent and experienced supervision.

At one of the district Agricultural Shows, held last November, the estate owners voluntarily contributed four prizes, to which the judges added a fifth prize, for the best farmers' canes then growing in the district. The result of this spontaneous evidence of the interest taken in good cane farming is reported to have been most beneficial, and as these prizes are likely to be offered in future years, there is every reason to expect a marked improvement in the small cultivations in that district.

In order to bring up to date previous records, I present the following table compiled from returns made to the Agricultural Society.

From this it will be seen that the number of cane farmers is still increasing and has more than doubled in the last ten years, and that notwithstanding this increase, the cane production on the estates has not diminished, except in the bad year 1905.

It can also be estimated (on the basis that the average yield per acre is ten tons of canes) that from 17,000 to 20,000 acres of land are under cane cultivation by farmers. Under proper cultivation this acreage ought to yield at least 400,000 tons of cane, or double the present output:—

CANE AND SUGAR PRODUCTION, TRINIDAD.

Year.	Total Sugar Production.	Estate Grown Canes.	Farmers' Canes.	Price Paid.	Cane Farmers. Number and Nationality	
	Tons.	Tons.	Tons.	$	West Indian.	East Indian.
1895 ..	55,000	No return.	35,000	—	—	—
1896 ..	59,000		75,000	—	3,744	—
1897 ..	55,000		—	—	—	—
1898 ...	58,000		105,000	203,000	3,824	2,326
1899 ...	58,800	426,000	106,000	219,000	3.870	2,826
1900 ...	46.000	364,000	106,000	228,000	3,591	2 826
1901 ..	61.000	434 000	170,000	369,000	4,737	3,819
1902 ..	57,830	338,000	185,000	327 000	4,850	4,506
1903 ..	47,000	337,000	166,000	348,000	4,440	4,443
1904 ...	48,000	385,000	172,000	360,000	4.685	4,646
1905 ..	38,240	244.418	144,863	432 0 3	5,462	5, 24
1906 ...	62,975	307,912	247,844	469,1 2	5,446	6,127
1907 ...	59,564	395,853	163,993	340,527	5 777	6,557

DISCUSSION.

Mr. J. R. Bovell (Barbados) asked whether the land referred to by Professor Carmody had not been out of cultivation for some time. As far as he could remember, the Government took over estate lands which had been out of cultivation for some time, and if this was part of the land referred to by Professor Carmody, that might account for the difference in yield.

Professor Carmody said that was not the case. Although the land was out of cultivation so far as the manufacture of sugar by the proprietors was concerned, yet it had been let by Govern-ment to tenants, and had been used for the purposes of cane farming ever since. It might be taken, therefore, as fairly representative of the cane lands of Trinidad.

Hon. Mr. H. Howell Jones (British Guiana) said that very little cane farming was carried on in British Guiana, the difficulty being the means of transport between the various villages and the estates. The development of the rice industry, therefore, does not in any way affect cane farming.

Dr. Francis Watts (Antigua) said that the basis of trading at Antigua was different to that described by Professor Carmody for Trinidad, although the effect might be somewhat similar. Peasants' canes were bought at the rate of 1½ lb. sugar per 100 lb. cane, which during last year realised 8s. 7½d. per ton of canes. He was unable to say how many acres there were in farmers' canes.

Hon. W. Fawcett (Jamaica) said there was a small amount of cane farming going on in Jamaica at Westmoreland, where one or two small estates had abandoned their machinery and were selling their canes to large estates. But there were no peasant farmers as in Trinidad,

TIMBERS.

TREE PLANTING.

BY GUY S. BAKER.

(From the *Agricultural Journal of British East Africa*, Vol. I., Pt. III., October, 1908.)

With the exception of a few species, tree planting with the object of producing timber does not pay the private individual unless he is a rich man who can afford to wait years for his profits, and it is even then a doubtful investment, as the money can usually be more profitably invested in some sound financial securities than in tree growing.

Forestry at its best yields small profits; to calculate these it is necessary to consider the compound interest upon the sum expended on the plantation from the age of one year until the crop is cut, or in the case of a permanent high forest the value of the land and the amount of capital the forest represents, the annual yield, then being the interest produced from the capital. Intermediate expenses have also to be included, and it is found that when all has been taken into account the interest on the invested capital rarely exceeds 3%. The above remarks apply solely to tree growing with the object of producing timber not to minor products yielded by forests such as rubber, bark, gum, fibre, peat, turpentine, bamboos, etc.

From 20 to 200 years are necessary to produce timber of any size according to the species grown. This period is termed the rotation, and if mistakes are made in the management of the crop they cannot be corrected until the end of the rotation. Moreover, forests are subject to many dangers, and it is not usually possible to sell them for their value in times of need or to borrow much money upon them. Forests, however, provide employment for a large number of workmen; it is estimated that 12% of the population is engaged in actual forest work.

Formation and Plantations.—To obtain plants for the formation of the plantation it is necessary to either dig up the seedlings from places in the forest where they are abundant, to raise them in nurseries, or to purchase them. The latter will be found most satisfactory when they can be procured at reasonable prices, and the cost of transport to the area to be planted is not too great. Digging up trees direct from the forest is usually attended with poor results, as the seedlings here grow under conditions which do not fit them for removal, and which are changed when they are in a plantation.

Nurseries.—A suitable piece of ground must be chosen for the nursery. This should be as near to the area to be planted as possible in order to avoid transport, and close to water. The soil should be light friable and well drained; soil which is apt to cake and crack makes a bad seed bed. The ground should be broken up fine, the finer the better in order to allow the roots of the young plants to penetrate. The beds may be made about 3 ft. wide, so that a man can reach to the centre to weed, and as long as is found convenient. Before sowing, the bed must be raked over and all lumps of unbroken soil removed. Should the beds be made on a hill side they must be made along the contour of the bank in order to prevent floods washing them away. The paths or trenches between the beds may be 4″ to 6″ deep. Before the seed is put in, the earth should be carefully worked in the beds and pressed down slightly, so that seeds may not be exposed to the washing away of the soil. The soil must be moderately moist but not wet enough to stick to the fingers; some seeds require the soil carefully mixed with charcoal, sand, or other substance before good germination can be assured, but it is not necessary to deal with such elaborate methods here. The seed should be sown in parallel drills or furrows 4″ or 6″ apart, as it will be found easier to afterwards weed the beds and to remove the seedlings; the sowing must be done carefully; the seed must not be thrown down in handfuls. It must be covered with earth to prevent it being washed away, it should usually be covered with its own thickness of soil. Large seeds are generally put in separately by hand, but small seed can best be sown from a paper packet or bottle. The season for sowing seed in this country depends upon the rate of growth of the seedling, it should be sown in time for the seedling to have reached a sufficiently large size to enable them to be planted out during the rains.

After sowing until the time of picking out the seedlings, the seed beds must be kept continually moist, not soaked with water one day and let dry the next. After germination the seedlings are liable to be attacked by a number of enemies. Many preparations have been invented for keeping off insects, but no simple remedy has so far as I know

proved quite satisfactory. Wood ashes sprinkled over the beds has often a good effect.

It will usually be found necessary to protect the beds from the hot midday sun by erecting a shade over them. As the seedlings develop the shading should be thinned out so as to accustom the seedlings gradually to the sun. After germination the seed beds require constant care or must be kept weeded. It not infrequently happens that the ground is allowed to cake and the seedling becomes yellow in consequence; the soil should then be loosened between the plants and be well-watered or irrigated.

Pricking out Plants.—As it is more satisfactory for several reasons to put large plants into plantations than seedlings, the seedlings are first pricked out some distance apart and allowed a height of usually not less than 9″. In Europe they are pricked out about one foot apart into beds, but it is here found better to employ the more expensive but surer method of potting them singly in pots or to plant them into shallow boxes about 4″ deep. They can then easily be moved to the plantation. Plants should be lifted from the seed beds as soon as they are a convenient size to handle. The larger the plant the more care it requires. The best way to lift the plant where the seed has been sown in lines is to dig a small trench parallel to the line and to push the seedlings in the trench by inserting a spade or trowel behind. The soil used for potting must be of the best; leaf mould mixed with an equal quantity of soil into which a slight admixture of ashes has been put will be found most suitable. The soil used must be taken from the surface when the air has acted upon it.

After potting, the transplants must be kept well-watered and put in the shade for a few days until rooted. It is a good plan to put the potted transplants under shades and to thin them gradually in the same way as is done in the case of the seed beds.

The size of the pot should not be less than 4″ diam. at the top and 4″ deep. They may be made of banana leaves or any similar material which will last sufficiently long to keep the soil together until the plants are ready to put out into the plantation.

Planting.—The size which plants should attain before being planted into places where it is intended they should grow is generally 9″ to 12″. The ages at which young trees reach the height depends upon the kind of trees.

The plantations should be selected in a place where the trees have a fair depth of soil, if possible, although trees are usually content with much poorer soil than farm crops, and for this reason are planted upon land unfit for agriculture they thrive best upon deep well-drained soils. Having chosen the site for the plantation the undergrowth must be cleared away, if dense it should be cut and burnt, the ground hoed or ploughed in order to root out noxious weeds.

In plantations the closer the trees are planted at the outset the better; although there is an additional expense in close planting it is more satisfactory because the closer together young trees are placed the better they shelter one another, and the soil close planting also serves the purpose of keeping down jungle weeds; the branches of the young plants soon meet across and exclude light without which weeds cannot grow. It will be seen, therefore, that by close planting there is a considerable after saving in the cost of cleaning the plantation, as instead of the weeds smothering the trees the latter are able to hold their own and eventually kill the weeds. Many kinds of trees unless grown in numbers close together never develop well. Fast growing trees such as Eucalyptus and wattle may be planted 4′ × 4′, slower growing trees should be planted 3′ × 3′ or even 2′ × 2′. The best season for planting is of course at the beginning of the rains.

Only healthy plants should be taken for planting out, all sickly or weak plants should be thrown away or left until another season when they may have recovered.

In cases where plants have been pricked out into banana leaf pots or trays there will be no difficulty in transport or in planting. If in banana leaf pots the pot may be planted with the plant, but it is better taken off. If in trays the plants should be carefully lifted from the tray with a ball of earth; a trowel will be found best for this purpose.

Should it be found necessary to transplant trees which have not been previously put into pots or trays, great care must be exercised in their removal. The most important point is to see that the roots are not injured. They may be dug with a ball of earth, but this is my experience especially when plants have to be transported any distance; it is difficult to keep the earth from falling away from the roots of the plant, and when the soil is light and friable almost impossible. Planting with bare roots has given poor results in this country.

The larger the holes dug for the plants the better, as the roots can then penetrate more easily into loosened soil.

Care should be taken to see that the level of the surface of the soil recurs at the same point on the stem of the plant as it did when the plant was in the nursery. The earth filled into the pit must be pressed down by the foot.

Tending the Plantation.—As soon as the trees are planted it is advisable to fence the plantation.

Plantation require to be cleared of rank jungle growth, while the plants are young where such growths choke the plants.

As the trees get taller they may require thinning. When the plantation is first formed there are several thousand plants on an acre of ground; as these develop it is obvious that some must be thinned out, it being impossible for all to remain alive on the same land till they have reached maturity. The object of thinning is to remove the weakest trees in favour of the stronger. The trees thinned out form an intermediate yield of poles which are useful for many purposes. Care must be taken when thinning that too many trees are not removed at one time, and that the canopy is not sufficiently opened to expose the soil. A good deal of skill is necessary in making the thinning, or more harm than good is done by the operation. Unless there is a particular species of tree which it is wished to favour, the suppressed and dominated trees only should be removed. A suppressed tree is one which is growing entirely in the shade of those surrounding it and which enjoys no light. A dominated tree is one which is dominated by those around it, only a few of its top branches being free to enjoy light. In heavy thinnings a number of the dominated trees are usually removed, but in light thinnings they are left and only suppressed trees cut.

Avenues and Windbreaks.—Avenues intended for shade to be effective should be formed of trees which grow to a height of 50 to 100 feet, and which form dense crowns. The trees may be planted at any distance apart and alternate trees cut out as found necessary. Unlike plantations, the branches of trees in an avenue should not be allowed to interlace, usually some protection is required against animals by young plants on the edges of roads. A wattle fence will be found cheapest and most satisfactory.

Avenues to be effective must be formed of the same kind of tree. Care must be taken when watering plants that the water does not lie round the stem, if it does the bark becomes softened, the sun then dries and hardens it, and the next application of water softens the bark again; if the process is constantly repeated the bark cracks and the plant dies.

Trees intended to form wind breaks should be planted at right angles to the direction of the prevailing wind. The lines of trees should be kept sufficiently far apart to prevent the branches of the trees in different lines interlacing. The object of this is to produce as much leaf surface as possible to stop the force of the wind. Branches of trees planted close together soon interlace, the leaves then drop off, and the bare branches offer little resistance to air currents.

HORTICULTURE.

DIDYMOSPERMA DISTICHUM.

This remarkable and rare palm is seldom seen in cultivation in Ceylon, or indeed elsewhere outside its native habitat, viz., Sikkim. It was introduced by the Royal Botanic Gardens, Peradeniya, in 1880, and has become quite established and acclimatised here. It may well be called the "Fanpalm," owing to the peculiar distichous arrangement of its long graceful feathery leaves. The latter are effectively set in a pretty network of black fibre and bristles, which forms a striking characteristic. The palm grows to a height of about 30 feet, and, like many other palms, dies soon after flowering and fruiting. The pinnate leaves are slender and arching, being about 15 feet in length from the base. There is a young avenue of this striking palm at Peradeniya.

HEDGES AND HEDGE PLANTS AT ANTIGUA.

(From the *Agricultural News*, Vol. VIII., No. 184, May 15, 1909.)

Very few hedges are in existence in Antigua, and with the purpose of giving an object-lesson to planters in this direction, successful efforts have been made to develop growing fences round the Experiment Station at Skerrett's. The plants mentioned which appear to be especially satisfactory for the purpose of the establishment of hedges are the bread-and-cheese (*Pithecolobium Unguis-cati*), the Barbados cherry (*Malpighia glabra*), and the logwood (*Haematoxylon campechianum*). Since the hedges at Skerrett's have attracted considerable attention at Antigua a number of enquiries have been received by the

See p. 134.

Photo by H. F. Macmillan.

DIDYMOSPERMA DISTICHUM.

Curator (Mr. T. Jackson), and it would appear that many people in the island are intending to follow the example thus started and to plant hedges on their own properties. Mr. Jackson recently forwarded to this Department some notes on hedge plants and hedge planting, which may be of general interest outside Antigua.

In addition to the three plants already named, Mr. Jackson mentions the hibiscus, the pomegranate (*Punica granatum*, *Agave Americana*, *Agave vivipara*, wild coffee (*Clerodendron aculeatum*), and several species of bamboo, all of which would be useful in the establishment of fences.

Apart from the use of these plants for larger hedges, trials made at the Antigua Botanic Station have shown that at least one or two of them can be utilized for the formation of low ornamental borders after the manner in which low 'box' hedges are frequently employed in England. These borders, when well cared for, form an attractive feature in an English garden, and in addition to their ornamental value, serve a very useful purpose in defining boundaries, and keeping up the sides of walks. Mr. Jackson points out that the bread-and-cheese plant, when kept well trimmed, forms a useful substitute for the 'box-edging' referred to, and there is no doubt that such dwarf bonndaries (kept about 8 or 9 inches high) could be introduced into West Indian gardens with striking effect.

The 'bread-and-cheese' hedge is established by sowing seeds on a border about 18 inches wide, the seeds being planted in drills from 3 to 4 inches deep. If a thick, rather wide hedge is desired, two rows of seeds can be planted, the rows being about 6 inches apart. When the young plants are abont 8 inches high they should be trimmed. The first trimming should consist only of taking off the points of the young plants so as to force them to grow from the bottom and form a shrubby undergrowth. If wet weather ensues, the next pruning should be performed a few weeks after the first. Subsequent trimmings will be at the discretion of the grower.

As already mentioned, in addition to their ornamental value as a dwarf hedge, these plants are capable of forming a useful boundary fence. The foliage is somewhat liable to be attacked by leaf-mining caterpillars, which disfigure it. When so attacked, it should be sprayed with kerosene emulsion.

Another plant which can also be grown to form a dwarf hedge is the logwood. It is not so satisfactory for this purpose, however, as the bread-and-cheese, on account of the fact that its shoots are so much stiffer and stronger growing. The best dwarf hedges of logwood are grown on very poor soil. On the other hand, if it is required to establish a fence for the purpose of keeping out stock, no plant is more useful than the logwood, since it forms a thick serviceable hedge, which is almost impenetrable on account of the thorny growth. Planted around cultivated lands it would certainly prove a formidable brrrier against prædial larceny. Like the bread-and-cheese, the logwood plants are best established by sowing seed at the place where the hedge is to be grown.

Two other useful plants for stock-resisting fences are the Barbados cherry and the pomegranate. The bright green foliage of the former makes its appearance very handsome. The seeds of these plants should be sown in a nursery and transplanted when the young plants are about 6 inches high.

The pomegranate makes a fine fence which can be established either by sowing seeds or planting cuttings.

Persons who are intending to plant hedges, which would at once be useful and ornamental, might well utilize the strong-growing hibiscus for the purpose. The best method to establish a fence of this would be to transplant rooted cuttings. A further advantage in favour of this plant is that the numerous varieties which exist offer the grower some scope for a colour scheme.

The Bougainvillæa, it is well-known, forms a fence of highly ornamental appearance. Plants of this must be propagated by cuttings or layers. In starting a hedge of this description the best plan would be first to establish a light trellis work, which would serve as a support for the young plants. Later on when the trellis decays, the plants would be able to support themselves. It is advisable that the quick-growing shoots should be tied in, and that pruning should be done freely.

A pant which has given very satisfactory results in Barbados and other islands for hedge purposes is the sweet lime (*Triphasia Aurantioda*). This, if kept well trimmed, forms a thick, bushy growth, which is ornamental, highly useful, and also quite capable of keeping out stock and serving as a general protection to the enclosed area. The only drawback to the more general use of this plant for the purpose mentioned is that its growth is very slow.

PLANT SANITATION.

ENTOMOLOGICAL NOTES.

BY E. ERNEST GREEN,
Government Entomologist.

I have examined fresh samples of the tea seedlings infested by 'Eelworm' (mentioned in last month's Notes). These had been gathered from different plots and prove that the whole nursery is equally affected. I have also been able to determine that the species is the common 'Root-knot' Eelworm' (*Heterodera radicicola*) which occurs practically all over the world. In Ceylon it has long been known to attack the roots of various garden plants and vegetables. In the present case the encysted female worms were found in numbers, occupying small cells in the bark and cambium of the diseased roots. A circular on this pest is being prepared and will be issued shortly.

Larger numbers of the young brood of the 'Spotted Locust' (*Aularchus militaris*) have attracted attention on an estate in the Rattota district. They are reported to be defoliating 'Dadap' (*Erythrina*) and Cinchona trees and to be sampling the tea, but without doing any serious damage to the last plant. The life history of this locust has been worked out. A single brood only is produced during the twelve months. The eggs are deposited in the ground in October and November; the young locusts hatch out in the following March, and gradually increase in size until August or September, when the adult winged insects appear; pairing and egg-laying complete the cycle in October and November again. These dates have been found to be fairly constant for the Kandy, Matale and Rambukkana districts; but they may very possibly vary in other parts of the Island, where the incidence of the monsoons is different. It is important to remember that it is the egg-laying period that is the most vulnerable point in the cycle. The eggs are always deposited in circumscribed areas of ground which—with ordinary care—may be located quite easily. If these spots are forked to a depth of about twelve inches and treated with quick-lime, very few of the eggs will hatch out.

Specimens of the 'Fringed Nettle-grub" (*Natada nararia*) have been received from Elkaduwa, where it is said to have spread over ten acres of tea. This is the species that sometimes gives considerable trouble on the Badulla and Haputale side of the Island; but its attacks seem to be less frequent and less severe in the Central Provinces.

The large hairy caterpillars of *Suana concolor* occasionally attract attention by their depredations upon various cultivated plants. A native cultivator from Harispattu submits specimens of this caterpillar for determination, and reports that they have eaten up a number of his cacao plants. They seldom occur in sufficient numbers to be a serious pest, but their large size and hearty appetite seldom fail to attract attention. Their very size is a safeguard, as they are easily seen and can then be picked off and destroyed. Care should be taken in handling them, as they are armed with a band of short but very sharp black hairs which can cause painful irritation.

Two separate correspondents have sent me specimens of the large white grubs of a Longicorn beetle, extracted from the stems of dead or dying rubber (*Hevea*) trees. The symptoms in each case make it tolerably sure that the tree had previously been attacked by some other disease, and that these insects had made their entry subsequently. I have not yet received satisfactory evidence of any boring insect being able to penetrate the latex-bearing tissues of a healthy rubber plant without being engulphed in the consequent flow of latex.

But a new rubber pest has put in an appearance in the form of a species of slug. My correspondent describes it as "a white snail about 1½ in. long," but subsequent enquiries showed that the creature was not possessed of a shell. He continues, "I caught one on the top of a tree, 'in flagrante delictu,' and found the same species at the bottom of each damaged tree. They creep up the stems at night and in the early morning, and nibble off all the tender shoots just breaking away, and the rubber plant or young tree hangs fire and cannot get a start. Some of the tops of the plants were transformed into green rods—full of sap—but with no growing points left. When the terminal growing point is destroyed the plant attempts growth at each axil lower down, only to be foiled every time by the snail." The slugs are said to retire into the grass or under dead leaves at the base of the trees during the daytime. The logical remedy will be to keep a clear space of bare earth around each tree and to sprinkle this occasionally with lime.

Mr. Maxwell Lefroy (Entomologist to the Government of India) informs me that, in India, the larvæ of the 'Pink Bollworm' hibernate in the cotton seed. To guard against the recurrence of the pest, the cotton seed is always fumigated before being sown. This habit of the bollworm may possibly account for its sudden appearance in the very first crop of cotton grown on the Experiment Station at Peradeniya, though it is difficult to understand how it could have occurred in such overwhelming numbers that practically every pod of the first crop was infested. There is no doubt that other cotton pests are liable to be introduced with imported seed, on which account I have recommended to Government the compulsory fumigation of all imported cotton seed.

Another bollworm, which is common both in India and in Egypt, is the caterpillar of the moth *Earias insulana*. Though this moth occurs in Ceylon, it has not hitherto been noticed here as a cotton pest. But a single example of what I believe to be this caterpillar was recently found in a cotton boll on the Peradeniya Experiment Station. Owing to an injury during its extraction from the boll, it failed to complete its transformations, so I am unable to determine the species with certainty.

The Vermorel acetylene lamp was placed in position in the cotton plots for one night, to see if the moths of the 'pink bollworm' (*Gelechia gossypiella*) could be attracted to the light and destroyed. But, though vast numbers of other and harmless insects were captured, not a single specimen of the Gelechia could be recognized amongst the victims.

The Camphor plants on the Experiment Station have been partially defoliated by a species of 'bag-worm' (*Clania variegata*).

In a Report on "Rubber in Nyassaland" (from the Government Handbook, 1st issue, 1909), mention is made of injury to Para rubber plants by cockchafer grub. "To get rid of the latter pest a mixture consisting of one pound of Paris green and three pounds of salt to 40 pounds of donkey manure was used and proved effectual, when dibbled in some little distance from the roots at the time of planting." This is the poisoned bait used against locusts in Africa. It might be tried (with the substitution of horse for donkey manure), under similar circumstances, on our rubber clearings in Ceylon.

The stems of a common climbing bean—in frequent use as a native vegetable—are sometimes attacked by the grubs of a large black beetle with enormously thickened hind legs (*Sagra* sp.). The presence of these grubs causes conspicuous tumour-like swellings on the stems. As many as fifteen of these white grubs have been found feeding within one of these swellings. It is astonishing that the plant shows such little sign of inconvenience from the presence of so many and such large insects.

In a recent number of 'Nature' (May 13, 1909) is a letter describing a method of killing house-flies by exposing dishes containing formaldehyde (in the proportion of two teaspoonfuls of the chemical to a soup-plate full of water). The flies are said to drink this mixture with rapidly fatal results.

MISCELLANEA: CHIEFLY PATHOLOGICAL.

By T. PETCH.

The death of tea and other seedlings in the nursery frequently results in serious loss, not so much from the value of the plants as from the delay it causes in the establishment of new fields. As a rule the seedlings die out in patches, but sometimes whole beds are destroyed. In many instances this is due to eelworms, and the cause can then be readily ascertained by examining the root, which in such cases is distorted and tuberous. When the plants are attacked by fungi, the stem usually turns black at the base, and the leaves fall off, but the root is not swollen. It was pointed out at the Rubber Exhibition of 1906, that the health of nursery plants depended chiefly on the care expended over the selection and preparation of the nursery. It often happens that, owing to difficulties with regard to water supply or the lay of the land, the same ground is used for nurseries continuously. It is quite true that the same patch can be used repeatedly as a nursery, but in that case it must be thoroughly worked between the sowings and preferably should bear a crop of some other plant before being used as a nursery again. Where the seedlings have been destroyed by any disease, it is useless to expect a subsequent healthy growth on the same ground without thorough and repeated working of the soil and the application of some method of disinfection. If possible, the site of the nursery should be changed.

In the case of tea seedlings, their death, when due to fungi, is usually attributed to *Pythium*, but this cannot be said to have been definitely established, and further investigation is necessary. An instance of the death of *Albizzia* seed-

lings was recently brought to notice, and in this case the cause was undoubtedly *Pythium*. But the fungus attacked the top of the plant, not the base of the stem, and bound together all the leaves and the stem with a white film of mycelium. It spread at first over the surface of the leaf and the apex of the stem, and then entered and killed the tissues.

When nursery plants begin to die off in patches, all the dying plants must be removed and burnt at once. If their death is not due to eelworms, the bare patches should be watered with one per cent. solution of formalin, *i.e.*, one part of commercial formalin in forty parts of water; or they should receive a liberal dressing of slaked lime. In the "damping off" of coniferous seedlings, it has been found that the disease was to a great extent prevented by disinfecting the beds with a one per cent. solution of formalin five days before sowing the seed; and further, that it could also be prevented by sprinkling clean sand, as hot as it could be handled, over the beds to a depth of about one-sixteenth of an inch immediately after the germination of the seed. It is obvious that when nurseries are attacked by any fungus disease, all shade should be removed as far as is possible without injuring the plants.

In the last number of the *Tropical Agriculturist*, it was stated that the death of the bark of Hevea, or at least its separation from the wood, must precede the accumulation of rubber between the wood and the bark. Since that was written, I have received, per the Editor of the *Times* and Mr. C. Northway, two specimens showing these rubber pads; they were described by Mr. Northway in the local papers on June 8th. Each specimen consists of a strip of bark, 10 centimetres broad (*i.e.*, horizontally round the tree), and 6 centimetres high. The thickness of the bark, after several days' drying in transit, is three to four millimetres (*i.e.*, three-twenty-fifths of an inch); it would be thicker when fresh. The trees had been scraped some considerable time before pricking, since each piece shows a well-developed outer brown layer, one-fiftieth of an inch thick, scaling off, and a further thickness of one-twenty-fifth of an inch turning brown; so that half the total thickness of the bark is already corking off as a consequence of the scraping. This uniform scaling off has nothing to do with the formation of the rubber pads. Specimen A has, in the middle, a patch of dead bark (*i.e.*, dead right through to the cambium) about 5 centimetres in diameter, with a pad of rubber of the same size behind it; it forms a blister raised about 6 millimetres above the surrounding level; there are two lines of pricker cuts across the specimen; one of these just touches the edge of the rubber pad. The other passes over the pad at a distance of one centimetre from its edge; the outer surface of the pad is marked with the incisions of the pricker, and fragments of bark have been pushed into it, while the inner surface bears corresponding projecting teeth of rubber which have been pushed out by the pricker; the pieces of bark within the pad and the marks of the pricker on both surfaces prove conclusively that the *pad was formed before the bark was pricked*. Specimen B is similar; the blister in this case measures 8 centimetres by 5 centimetres, and the rubber pad is one centimetre thick; there are three lines of pricker cuts, of which the upper and lower just touch the edges of the pad, while the middle line goes right across it, but, in consequence of its thickness, the pricker cuts do not penetrate completely through it; as before, the dead bark has been driven by the pricker into the pad, and this shows that the pad was formed before the bark was pricked. The bark round the blister, which was living when pricked, shows only the usual pricker cuts through it. In specimen B, a new bark is growing under the edge of the pad at one side, and as this new bark is 6 millimetres broad, the pad must have been in existence for some time.

Further light is thrown on this phenomenon by another specimen which has been sent in, showing the death of the bark in patches after scraping. In this case it was detected at once, and there had been no time for its separation from the wood and the consequent formation of a rubber pad. Normal Hevea bark is protected from injury by its outer brown dead layer. When this layer is scraped off, the inner tender living tissues are exposed and they immediately begin to die back. As a rule they die back uniformly and form another continuous outer brown layer, but in some cases, a patch of bark two or three inches in diameter dies right down to the cambium. When this dead patch splits away from the wood, rubber pads are formed by the inflow of latex from the surrounding healthy bark. There seems to be no explanation, other than exposure to sunlight, etc., for the production of these patches of dead bark. I have not been able to find any fungus in them, though there is a well-known semi-parasitic fungus of *Hevea* which might be expected to produce such a result. The fact that the dead bark is strictly

limited, *i.e.*, that the effect does not spread continuously, argues against any fungus agency.

The facts detailed above support the statements that (*a*) the rubber pads can form independently of the use of the pricker, (*b*) the bark dies in patches in consequence of scraping, (*c*) the rubber pad is formed after, not before, the death of the bark.

Exception has been taken to the statement recently made in this column that the rubber in Hevea is a "waste product." There have been practically no experiments or observations in this direction, the majority of investigators having occupied themselves with the question of obtaining the maximum amount of rubber from the tree, without troubling to consider how and where it was formed. The following observation tends to support the "waste product" theory. If a naturally shed Hevea leaf is taken, and a thin layer of the midrib on the back of the leaf is peeled off slowly, strands of rubber will be seen stretching across the angle between the strip which is being peeled off and the remainder of the midrib. This shows that when the leaves are shed naturally, *e.g.*, at the initiation of the "wintering" stage, the rubber which they contained remains in them. The same result may be obtained with rather more trouble by extracting the rubber from the fallen leaves by means of carbon bisulphide. Now, according to Sachs' investigations, before a tree sheds its leaves, all the potash, phosphoric acid, starch, etc., in them—in fact everything which can be of further use to the plant,—is transferred from the leaves to the stem. The dead leaf retains only waste products. The fact that the rubber is cast off in the dead leaf tends therefore to support the view that it is also a waste product.

It is generally believed that all the rubber which is formed in the stem of a tree accumulates in the laticiferous tissue until the planter chooses to tap it; that if he does not tap until the tree is eight years old, he will obtain all the rubber which was in the tree when it was, say, six years old, plus the amount which has formed in the additional two years. From a botanical standpoint this is improbable. After the stem has passed its green stage, it acquires the normal secondary cortex with a dead corky layer on the outside; and as it grows older, this corky layer increases in thickness. But the corky layer is formed from the laticiferous layers. This is readily seen when a tree is pared; the exposed laticiferous tissue is then rapidly covered by a new corky layer which is obviously formed from it. Further, if a tree is tapped by the full spiral method with spirals one foot apart, and the tapping is stopped after a breadth of six inches has been cut away along each spiral, the original bark left between the spirals will in some cases scale off in flakes down to the level of the renewed bark. I have taken off scales of brown bark, ten inches long, which were formed between two spirals. Now, the brown corky layers, and the scales just referred to, were originally laticiferous; and the current belief *assumes* that this latex was transferred inwards to the inner bark when the corky layer was formed. But if the brown scales of corky bark are pounded up in a mortar, and then extracted with carbon bisulphide, it is found that they contain an appreciable quantity of rubber. Just as in the case of the leaves, therefore, rubber is discarded with the brown bark, and thus the current belief is shown to be incorrect. When laticiferous bark is converted into corky bark, the latex which it contains dries up, and the rubber is left in the dead layer. Some of the rubber which was in the tree at the age of six is undoubtedly rendered unavailable before the tree is eight years old. The amount might be estimated if the rate of growth of bark were known; it cannot be a very considerable quantity when the tree is young.

It appears therefore that the tree is always discarding rubber as well as manufacturing it, the balance being of course in favour of the latter process. This obviously contradicts the idea that the rubber from a six-year old tree is itself six years old, or that rubber extracted from an eight year old tree is necessarily older than that extracted from a six year old tree. However, this contradiction is superfluous, for it is evident that in any tree most of the latex is derived from near the cambium in the present systems of tapping, and that that latex is the most recently formed.

It must be pointed out that the experiment referred to here is qualitative only, *i.e.*, it only proves that rubber is discarded with the dry brown bark. Obviously it is necessary to compare the actual weights of rubber in equivalent volumes of laticiferous and brown bark respectively, before it can be asserted that *all* the rubber in a given thickness of laticiferous bark is rendered unavailable when that bark is transformed into the corky brown layer.

This is not intended to serve as an argument in favour of early tapping,

That interpretation of the experiment would involve the confusion of two distinct theories, viz., (1) that all the rubber formed is stored in the laticiferous tissue and so "matures" there, and (2) that the rubber formed at the age of six is as "strong" as the rubber formed at the age of eight. The experiment proves that the first of these is, at least in part, incorrect; it gives no information whatever with regard to the second.

NOTES ON PARASITES OR INSECTS THAT HAVE BEEN INTRODUCED FROM FOREIGN COUNTRIES TO CHECK OR EXTERMINATE INJURIOUS INSECTS.

Extracted from the Official Report on Fruit, Fly and other Pests, 1907-8.

W. W. FROGGATT.)

PARASITES, AND THEIR VALUE AND LIMITATIONS IN CONTROLLING INJURIOUS INSECTS OF THE GARDEN AND ORCHARD.

One of the most interesting problems in the study of economic entomology is that of how far we can avail ourselves of the services of predaceous or useful insects that devour the injurious species, by introducing them from other countries to check or exterminte in an artificial manner native pests, or foreign accidentally-introduced ones that have become pests in their adopted home.

The subject is such a fascinating one, that most people are apt to rush to conclusions before the matter has been investigated from all points of view.

After many years' study in Australia, both in the field and laboratories, after information received personally from entomologists, horticultural commissioners, orchardists, and inspectors during my extended travels, and after careful reading of the many reports, bulletins, and newspaper cuttings issued, I propose to state my views on this problem, and shall quote in conclusion the opinions of some of the leading authorities on the question.

It is a fact that, if it were not for the countless millions of parasites (the majority of them so minute that their work is never observed) which swarm in our gardens and fields, there would be such an overwhelming multitude of caterpillars, grubs, aphides, and scale insects at work, that there would not be a green thing on the surface of the earth. Nature in this abundance of natural checks has provided for this balance of power, and it is so maintained under the ordinary natural conditions of the native forest and plains. Thus probably not more than 5 per cent. of the millions of eggs laid ever reach maturity and develop into the adult insect.

From their size, colour, and activity the fact that ladybird beetles were useful insects was well known by entomologists at a very early date, and in Kirby and Spence's Entomology, published in 1816, the authors called attention to the value of the common English ladybird beetle to the hopgrowers in devouring their great pest, the hop aphis, in the south of England. "If we could but discover a mode of increasing these insects at will, we might not only clear our hot-houses of aphides by their means, but render our crops of hops much more certain than they now are."

This is one of the earliest suggestions made regarding the artificial production of parasites. It is rather a significant fact that though this ladybird (*Coccinella septempunctata*) is often so abundant in Kent that they are either blown out to sea in such quantities that the returning tide sweeps them up in long ridges along the sea shore, or else they cause quite a scare by swarming into the houses in the summer time, yet the hop aphis regularly occurs every few years as a very serious pest. I, with many of the leading entomologists of the world, contend that, while we quite recognise the importance of parasitic insects in the work of keeping down insect pests under natural conditions of climate and cultivation in their own land, yet we certainly dispute the statements continually being made that every pest (and they even proposed to cure the bacterial disease "pear blight" in California with a parasite) can be dealt with by finding and introducing parasites from the country whence the pest is supposed to have originated.

If wishing for popularity, nothing could be simpler than to advocate the adoption of parasitic methods, for there is a certain amount of plausibility in the theory of introduced parasites to eradicate all pests that appeals to in the general public, who have not gone into the why and the wherefore of the matter, and particularly to the orchardist, who naturally wishes to give up spraying and fumigating, if he can simply turn out a colony of parasites, sit back, and they will do the work. As the results of the parasite introductions become better known, and the misstatements and exaggerations with which they have been surrounded are swept away, there will be a revulsion of feeling, results credited to parasites will be explained in other ways, the introduced parasites will take

the position in our methods of eradicating pests that their services deserve, and will not be extolled as a cure for every ill connected with horticulture.

Any observant person can follow the rise of insect life in its native land under natural surroundings. For example: A tree becomes so badly infested with scale insects that they form a regular incrustation on the stem and twigs, then, as with one of our commonest eucalptus scale insects, *Eriococcus coriaceous*, we soon find a host of hungry insects taking it in hand. Several of the black ladybird beetles (*Rhizobius*) devour the scale both in the beetle and larval state; then, too, the eggs of the pretty little moth *Thalpocharis coccophaga* are placed among the scale by the moth, and the resultant larvæ not only devour the scale but use up portions of their outer skin to construct the stout cocoons under which they are well protected. Other parasites also are attracted by the abundant food supply, until the twigs are only frigned with ragged bits of scales, and before the season is over the tree is apparently clean and quite recovers its former vitality. If, however, you visit the same bush the following season you will be almost sure to find it more or less infested with the same scale from the survivors of the last year; it was only the surperabundance of scale that had been destroyed; and the infestation will increase until it again attracted insects looking for food, which again breed np.

It is a question of cause and effect; the pest must appear before the parasite, or there is no food, and in the forest and uncultivated land this works out its own salvation; but under the different conditions of the growth of cultivated plants and trees we cannot afford to wait until they are badly infested.

And another important factor in the sole control of pests with useful insects is that the latter cannot eat up all their food supply, or else they in turn would die out, while if they leave even a small percentage in the orchard (in particular) their value is very much discounted.

Changes of climate make an immense difference to insects; and thousands of parasites have been forwarded from temperate climates to semi-tropical countries, with the result that, though surrounded with food when liberated, they have wandered away and died. This was the case with large quantities of ladybird beetles that we sent to India and Ceylon some years ago; there was plenty of food for them, but they never became acclimatised, so the experiment was dropped, and other means were taken by the tea and coffee planters.

It has also been the habit to credit the introduced insect with all the dead scale upon the infested plant, whereas we always find on a badly-infested tree a large percentage of dead scales that have died or remained undeveloped from many other causes. The native useful insects, perhaps more numerous than the introduced ones, and often quite as active, are ignored in the glowing and usually exaggerated accounts given by the parasite introducer.

There is another great factor in the increase of insect pests that under their natural surroundings were perfectly harmless to cultivated plants and crops; we cut down and burn up the forests and plough up the grass lands, and thus destroy the food supplies of the insects that existed there. Many of the more delicate perish, while the more robust, or those that are fortunate enough to find plants alied to those destroyed in the newly-planted trees or field crops suitable for food, turn their attention to the cultivated things, and adapting themselves to the altered conditions and with a bountiful supply of food, they often increase to such swarms as to prove the very worst kind of pest.

The question is often asked "Why do the grasshopper, locust, and cutworm plagues only occur every few years in a very acute state, though we always have a few about?" There are several reasons:—First, climatic conditions, such as a very dry or very wet season, check or increase the development of the eggs; next, we find that many of these recurrent plagues gradually increase in intensity for several years until they have reached their limit; then parasites increase in proporation, or fungus diseases, which are spread by the immense number of insects contaminating the feeding grounds, ill them off in millions.

Before we can go into the question of pests and parasites, it is only reasonable that we should first know something about the habits and life histories of the insects of both pests and parasites before we attempt to alter the balance of nature, and set "bug to fight bug" —a pupolar saying in the United States. Yet we are often told, in the newspapers and elsewhere, that it is not necessary to be an entomologist to undertake the collection and introduction of foreign parasites; that it is a disadvantage, in fact, for one may be too good an entomologist to be a practical man. The danger of a practical man who is not a naturalist introducing noxious insects or the parasites of useful insects is very much greater than if the

work be in the hands of a trained entomologist who knows his work. The latter may not introduce so many insects, but there is a very much greater possibility of their being of use.

The ideal introduced parasite is one that can be bred in a large State or a private insectarium in sufficient numbers that it can be distributed just at the critical time when the particular pest it destroys is in evidence, which, when it is once liberated in the orchard and garden, can establish itself against all comers in sufficient numbers, adapt itself to its surroundings, and, when its food supply is exhausted or has reached the vanishing point (a natural consequence if it is to be an effective parasite), will either find some other insect to devour, or will hibernate until fresh supplies come into existence.

The discovery of such an admirable parasite has been proclaimed again and again; but it is much to be regretted that it has become the habit of entomological collectors to enlarge upon the great value of their discovery before the insects have reached their destination, and to proclaim, not what it has done, but what it is expected to do when introduced into its new home.

Its admirers should be perfectly honest; and if a friendly introduced insect from which, rightly or wrongly, great things had been expected turns out on further trial to be a failure, they should say so; and they should never proclaim results for a parasite till those results have actually been proved in its adopted country, for the wisest can never be sure of the results of any experiment.

Economic entomology is a great commercial science, and those at work for its far-reaching interests could do it no greater harm than by misleading or unproved statements.

MISCELLANEOUS PESTS.

THE PROPAGATION OF *LORANTHUS*.

(Extracts from "Observations on the *Loranthaceæ* of Ceylon," by F. W. Keeble. Trans. Linn. Soc., Vol. V., Pt. 3, 1896.)

Many Cingalese members of the genus *Loranthus* have large and conspicuous flowers; in such the corolla is brightly coloured, more or less tubular, and generally 5-lobed.

In many of the Cingalese species a slit occurs in the corolla-tube, whereby, at the time of opening, the upper part of the tube by growth of its inner surface opens out laterally, so that all the five lobes, whose inner surfaces also at the same time grow more rapidly than their outer, come to stand in a row, and the stamens also which arise from the bases of the lobes similarly stand side by side.

In enquiring into the significance of these slits it must be remembered that, as other observers have already shown, these tube-flowered *Loranths* are bird-fertilized. My own observations confirm this, for in Ceylon the common honey-sucker, a species of *Nectarinia*, is always to be found, especially in the early morning, visiting these flowers.

I shot some of these birds which were busy in a *Loranthus* bush and found their beaks covered with pollen. Whether other birds also act as carriers of *Loranthus* pollen I could not determine. Now, birds are less precise in their methods than butterflies, and the pollen-carriers—their beaks—are much larger and by no means symmetrical. By the spreading slit or throat a bird's beak has ample space to reach the nectar which fills the bottom of the tube. Thus the natural slit saves the flower to some extent, but not wholly, from being torn. Further, the arrangement of the stamens side by side, rendered possible by the opening out of the part of the corolla-tube above the slit, has the important effect of exposing the dehiscent surfaces of all five stamens to one side (the upper) of the birds's beak, so that the pollen is rubbed on the whole of that surface. Since the stigma, projecting beyond the stamens, is so placed that it too will touch this upper surface, it is clear that the confinement of the pollen to this surface, effected in the manner just described, tends to render pollination more certain.

The most noticeable appearance in a bush of *L. loniceroides* is the large number of fully mature flower-buds contrasted with the number of open flowers. The explanation is simple. The flower-bud of *L. loniceroides*, though fully developed in all respects, remains closed. If the apex of the corolla of such a flower-bud be gently struck, the lobes fly apart, exposing stigma and ripe pollen-bearing stamens. These lobes, once released, continue, by growth of their inner surfaces, to bend backward till they are reflexed on themselves, and there is no doubt that fully-developed flower-buds

remain closed, when all that is required for the release of the adherent apices of the lobes is a gentle tap. Such a tap is provided by the fertilising agent, a bird (a species of *Nectarinia*); and I would suggest that this remaining closed of the ripe flowers is an instance of close relationship, beneficial to both "parties," between flower and fertilizer; the bird knows it is worth its while to "tap a new barrel" as it were; moreover, the parts of the flower are protected from the damaging effects of exposure to wet.

Such *exploding flowers* are by no means confined to this species (*L. loniceroides*), but in a more or less degree characterize the Cingalese large-flowered Loranths.

Whether opening of ripe flower-buds without a tapping on the apex occurs, I cannot assert; although various observations seem to show that, at all events, many buds, unless tapped, remain closed.

Thus unopened corollas which have become detached at the base of the tube, and slipped down the style, are commonly to be seen hanging on this persistent style. In such cases there is some chance of self-fertilization, as has been suggested for other genera. The inaccessibility of the flowers rendered experiment difficult; but the following was tried, with a view to determining the question of the opening or non-opening of the untouched flower-bud. Twelve apparently fully-developed flower-buds of *L. loniceroides* (on a Peach tree) were covered by fine muslin. At the end of three weeks the results were:—

Unopened.	Opened.	Unopened and dropped.	Opened and dropped.
4	2	4	2

so that, though the numbers are too small to admit of generalizing, it may be pointed out that two-thirds of the flower-buds did not open—and that the sources of error, such as rubbing against the netting, all favour of the opening of the buds.

The first day on which explosions were observed by me was bright and sunny, and it was subsequently noted that the explosions occurred with greater readiness on such occasions than on days when rain was falling. When a host-branch was cut down, the flower-buds on the *Loranthus* bush borne by it soon—in the course of less than one hour—lost their power of opening, even in response to a smart tap.

In addition to the "use" suggested above for this prolonged flower-bud state—viz., in procuring a closer relation between flower and fertilizer—another advantage, the protection of the pollen from rain, may be urged.

It might be supposed that in tropical flowers there is no need for protection against damp or rain effects, but the *Loranthaceæ* of Ceylon, probably for a reason to be referred to immediately, flower very largely in the wet season, and of the fifteen Cinhalese species five are, according to Trimen, confined to the moist low country (*L. nodiflorus*, *L. ensifolius*, *L. lonchiphyllus*, *L. Gardneri*, and *L. capitellatus*).

Many of the Cingalese species flower all the year round, and when I mention that eight species which do so grow in the hills, and that of these hills Blanford states "the only season that can be called fine is restricted to the first 4 or 4½ months of the year, and even in these it rains on one day in 3 or 4," it will, I think, be conceded that a protection of pollen against rain is by no means unnecessary.

Roxburgh, in his 'Flora Indica,' and Kurz, in 'Forest Flora of British Burmah,' both distinctly mention, in describing various species, that some, *e.g.*, *Loranthus scurrula*, flower during the wet season, and that others flower all the year round.

Hence I conclude that this "exploding mechanism" has the highly important function of protecting the pollen from rain, and that an additional advantage is gained in that a more specialized relation between bird and flower is enforced.

The "reason" why flowering occurs during the wet months lies probably in the fact that the seeds will only germinate in moist air; at all events I have found that in moist air the hypocotyls reach their host-branch in a few days, whereas in dry air two weeks are often insufficient. Hence it may be that many *Loranthus* species have acquired the habit of flowering in the wet season in order that their seeds may germinate rapidly, and on this view the special pollen protection is of no little interest.

Mode of Distribution of the Seeds.

The berry-like fruits of these Loranthus are, technically speaking, indehiscent; yet, owing partly to growth of the embryo, partly to the weakening of the fruit-wall, in some species, this latter becomes ruptured on the ripening of the fruits, *e.g.*, *Loranthus neelgherrensis*, *L. cuneatus*; in others a very slight pressure is sufficient to cause the complete extrusion of the seed, sometimes basally, sometimes apically. In most

cases the seed slips out, but in *Viscum orientale*, Wild., a gentle pressure causes the fruit-wall to crack and the seed to be jerked out. The fruits of Cingalese Loranthaceæ are comparatively large, often 2 cm. in length.

On the other hand, the two birds which in Ceylon chiefly feed on the *Loranthus* fruits are very small; one *Dicæum minimum*=*Dicæum erythrorhynchum* (Legge), is the smallest bird in Ceylon; the other is *Pachyglossa vincens* (Legge)=*Prionochilus vincens* (Murray), a flower-pecker peculiar to Ceylon. Of these, the former has, on account of its assiduity in visiting *Loranthus* fruits, earned for itself in Ceylon the name of the 'Parasite-bird.'

The smallness of the bird and the largeness of the fruit may together constitute the main reason why the bird has adopted—as will be shown—the habit of squeezing the seed out of the fruit and rejecting the fruit-coat. The large quantity of tannin which this fruit-coat contains may also have operated to produce this result. That the above-mentioned birds have acquired the habit of extracting the seeds is shown by the following observations. Under a tree, bearing a *Loranthus* bush in fruit, many empty husks are to be found, and such husks bear V-shaped marks of birds' beaks. I have also seen a bird, *Dicæum minimum*, perched on a *Loranthus* bush sucking a seed, having rejected the husk. This proceeding is doubtless a very general one with birds. The 'Paddy-bird' in Ceylon extracts the rice-grain and leaves the husk; and I have seen a Parrot "shuck" a pea-pod, extract the peas, and reject the pod.

Further, in none of the many birds I shot and dissected, did the gut contain a fruit-coat, though it was generally quite distended with pulpy matter which had been extracted from the fruit. That this habit of squeezing out the seed betokens a special love, on the part of the birds, for *Loranthus* berries seems shown by the fact that other birds, which only visit the fruit when their more usual food is scarce, have *not* acquired the habit. Thus I shot a common Bulbul (*Chloropsis Jerdoni*) in whose crop were several *whole fruits* of *L. loniceroides*. About a dozen 'Parasite-birds' were dissected; in some pulp only was found (pulp of *L. loniceroides*), in others pulp with one seed, in others pulp with as many as three seeds.

Of the seeds so obtained, some (*L. neelgherrensis*) germinated successfully; others, however, were soft and rotten, having been quite killed by the digestive juices.

Now, in the course of a morning, a bird visits far more than three fruits; indeed, the assiduity of the bird in gorging berries is remarkable; yet three was the greatest number found. Moreover, of seeds swallowed, some are so attacked by digestive juices as to be killed; thus when, as not infrequently happens, groups of seeds of *Loranthus* and *Viscum* species are found mixed with birds excrement, most are completely rotten.

Hence probably the birds seek the large fruits of such *Loranthus* species as *L. longiflorus*, *L. loniceroides*, *L. neelgherrensis*, *L. capitellalus*, &c., primarily for the pulp formed from the middle layer of the fruit-coat; but occasionally the birds in their greed swallow the seeds; and of these, some are digested to an extent to render them unfit for germination, while possibly others pass through the gut uninjured. If a reason other than that of the large size of many of the Ceylon species of *Loranthus* be sought to account for the fact that the birds generally avoid swallowing the seeds, it may perhaps be found in this,—that the endosperm and embryo of such seed as those of *L. neelgherrensis*, *L. loniceroides*, and *L. longiflorus*, and probably of many others, are exceedingly rich in tannin. A curious observation confirms the view to which the above remarks point, viz., that the birds get rid of the seeds by wiping or striking their bills against branches or other convenient objects. At the Hill Garden of Hakgala (5,500 ft.) *Loranthi* grow luxuriantly. On the single telegraph-wire there are every year hundreds of seedlings of *L. loniceroides*, all in early stages of germination. It can hardly be supposed that the seeds arrive at this anomalous position as a consequence of being voided, but rather that the birds free their beaks of them by striking or rubbing against the wire.

If due weight be given to the above-enumerated considerations and observations, it will, I think, be conceded that, at least in the majority of cases, the seeds of the large species of *Loranthus* reach their hosts without having passed through the alimentary canals of birds, and that their distribution is associated with an acquired habit on the part of the birds. This acquired habit consists in the birds first extracting the seed from the fruit-covering, and secondly, rejecting the seed and fruit-wall, both of which are rich in taninn, the bird's object being to obtain the sweetish pulp (which contains a little, but only a little tannin); and thirdly, in the wiping-off of the seeds which stick to the bill on a convenient place, usually a branch.

The alternative mode of distribution mentioned by Engler and Prantl, whereby the seed, shaken out from the fruit as it falls, sticks to any opposed object, is, I believe, of such rare occurrence as to be negligible, although the seeds are frequently *dropped by birds*, feeding on a branch, on the ground beneath.

PROFESSOR ROSS' LECTURE BEFORE THE ROYAL INSTITUTION OF GREAT BRITAIN.

(From the *African Mail*, Vol. II., No. 85, May, 1909.)

On 7th May, Sir Francis Laking, Bart., G. C. V. O., Vice-President in the chair, Major Ronald Ross (Nobel Laureate) read a paper before the Royal Institution of Great Britain on "The Campaign against Malaria." The following are extracts from the above paper:—

More than nine years ago I had the privilege of addressing the Royal Institution on the subject of my researches on the mode of infection in malarial fever; and I am now called upon to describe what has been done, or not done, in various countries to utilise for the alleviation of the disease the information then obtained.

As described in my previous lecture, the broad principles of this theorem were really fully established by the end of the year 1898. Although numerous minor details still required study—such as the precise species of mosquitoes which carry the infection in various countries, the exact habits of each species, and so on,—yet I held that these questions could now be elucidated without difficulty in the ordinary course of work, and that we are already in a position to apply the discovery at once to the saving of human health and life. I propose, therefore, to take up the story again from this point.

First, let me emphasise the great importance of this practical side of the subject. Malarial fever is spread over nearly whole of the Tropics, abounds in many temperate climates, and has been known to extend as far north as Sweden. In vast tracts of Tropical Africa, Asia, America and of Southern Europe, almost every town and village is infested by it; millions of children suffer from it from birth to puberty; and native adults, though they tend to become partially immune, still remain subject to attacks of it. Although it is not often directly fatal, yet it is so extremely prevalent, so edemic in locality, so persistent in the individual, that the total bulk of misery caused by it is quite incalculable. More than this, its special predilection for the most fertile areas renders it economically a most disastrous enemy to mankind. Throughout tropical life it thwarts the traveller, the missionary, the planter, the soldier, and the administrator. From one-quarter to one-half of the total admissions into military hospitals are returned as being due to it, and it is often the most formidable foe which military expeditions have to encounter. There are reasons for thinking that it directly increases the general death-rate of malarious countries by something like 50 per cent., and I venture to say that it has profoundly modified the history of mankind by doing more than anything else to hamper the work of civilisation in the Tropics. Only those who have studied the disease from house to house, from village to village, can form any true notion of the total effect which it must produce throughout the world.

Next let us recall briefly the various methods which we possess for preventing and reducing the disease. The oldest of these—known to us since the time of the Romans—*is drainage of the soil*. The reason why it succeeds became quite obvious after 1898—because it tends to remove the terrestrial pools and marshes in which the *Anophelines*, that is, the family of mosquitoes which carry malaria, breed. But the new discoveries not only explained the old method, but also rendered it more simple, cheap, and yet precise by showing us exactly what waters, namely, those in which the larvæ of the *Anophelines* actually occur, are to be drained away, or filled up, or otherwise treated. But science has given us other methods as well. Thus we have known for a long time that *quinine* is a preventive as well as a cure—that if, for example, a body of men are given quinine with regularity they will suffer less from fever in consequence. Still further, the old saying that the use of *mosquito nets* at night will keep off malaria was now fully justified—not because the nets exclude any ærial poison, but simply because they exclude the infecting insects.

This simple precaution can, moreover, be extended by protecting all the windows of a house by *wire gauze*, as already frequently done in the Southern States of America. *Punkas* and *electric fans* also serve to keep away the insects; and lastly, *segregation* of Europeans from native quarters, as used so largely in India, will help to keep them from mosquitoes infected by native children (who suffer so frequently from the disease). It was thus apparent that if the inhabitants of malarious countries could be persuaded to protect themselves by

mosquito nets or quinine, or if the Governments of such countries could be persuaded to undertake suitable drainage and other measures against mosquitoes, much improvement in the public health was likely to accrue.

But how precisely was such persuasion to be undertaken? Of course I do not allude to utterly barbarous peoples, to areas far beyond the influence of civilisation—which are happily shrinking in magnitude every day. I allude to independent or dependent States professing themselves civilised, and to the numerous colonies of the great civilised nations. Here we already possess the requisite machinery. Such States or colonies are administered by Governors and Councils, and for the most part possess medical and sanitary departments controlled by well paid Officials, whose special duty is to attend to such affairs. Many dependencies, moreover, such as some of those of Britain, are placed under the central government of the nation concerned, and can be influenced by it. It might be supposed, then, at the period referred to, all such administrations would have gladly interested themselves in the prevention of a disease which produces so much mischief, and of which the cause had been so clearly elucidated; that they would at once have set about collecting preliminary information and commencing at least some experimental trials. So far as I can see there is no real reason why this was not done everywhere nearly ten years ago.

Unfortunately, though science may provide us with facts, humanity is slow to credit them, and still more slow to take advantage of them. History is full of examples of this. For instance, years elapsed before the discovery of Jenner was fully utilised—it is not fully utilised even yet. Another instance, closely connected with malaria is that of *filariasis*, a parasitic disease of which *elephantiasis* is one manifestation. More than thirty years ago very good evidence was given to shew that it is carried by mosquitoes; and, considering the horrible and widespread deformities which it produces, one would have thought that strong efforts would have quickly been made to control it by reducing the carrying agents. So far as I can ascertain, however, scarcely anything has yet been even attempted against it. No one has interested himself seriously in the matter, and consequently nothing has been done.

It was therefore early apparent to me that, although the machinery for extensive anti-malarial work existed in many countries, yet it would not easily be got to work unless someone could be found who would devote himself to the task —neither a pleasant nor a profitable one —of urging it forward, and I felt that the duty devolved on myself in the absence of others, as regards British territory. Happily Angelo Celli and Robert Koch occupied themselves similarly as regards Italy and Germany; and the creation of the Schools of Tropical Medicine in Liverpool and London in 1899 did much to popularise the recent discoveries.

When I left India in 1899 I hoped that the great dependency of the British Crown, with its powerful Government and well-appointed medical and sanitary services, would lead the way against malaria, a disease which causes untold sickness and possibly some millions of deaths annually in the country; but though many local campaigns have been started by individual medical men, and though there has been a steady fall in the malaria rate of the army, I can find no evidence of the generalised effort against the disease. Less than three months ago I attended the Medical Congress at Bombay, largely for the purpose of inquiring into the reason of this, and concluded that though many capable officers both of the Indian Medical Service and of the Royal Army Medical Corps had done their best, yet that the necessary leadership and organisation were wanting in India as in West Africa. An ill-judged and ill-conducted experiment at Mian Mir had done much to paralyse all efforts in this direction, and I gathered that anti-malarial campaigns were not popular among certain officials. Neither the Indian Government nor the Medical Services can be congratulated on the result.

Some years ago the Secretary of State for the Colonies issued a circular to the Governors of Crown Colonies asking for information as to what has been done in each against malaria and other mosquito-borne diseases, and statements on the matter from twenty-one colonies were published in the Report of the Advisory Committee of the Tropical Diseases Research Fund for 1907. I have critised these statements in detail elsewhere. Only those furnished by seven Colonies, namely, Southern Rhodesia, Papua, Mauritius, British Central Africa, Gambia, Ceylon, and Southern Nigeria, shewed evidence of any real interest in the matter.

For a number of years I have had very good opportunities of learning the truth as to what is really being done in many of these and other dependencies.

It may generally be summed up in two words—very little.

Festering pools, which might have been cleared years ago for a few shillings or pounds, are left in the heart of important towns to posion all around them; quinine prophylaxis is neglected, and house-screening forgotten. Few efforts are made even to estimate the local distribution of the disease, much less to organise any serious efforts against it, although it may be causing, perhaps, half the sickness in the place.

Want of funds is always an excuse which is urged, and is always a false excuse. Much can be done at almost no expense, and the men who have actually carried out the work successfully in Panama, Ismailia, the Federated Malay States, and Italy, have expressly declared the cheapness of it. Many a town could be kept clear of malaria for the amount, say, of the salary of a single European official. I estimate that a sixth of the medical and sanitary budget should generally suffice to reduce a disease which often causes half the sickness. But instead of doing really useful work which would benefit everyone, the Authorities too often fritter away their funds on trifling schemes. I maintain that the health of the people has the first claim on the public purse.

Another excuse is that the possibility of preventing malaria has not been proved, but when one questions the sceptics one generally finds they have not troubled to study literature.

I have now outlined the general course of events. The immediate success which we had hoped for ten years ago has not been attained.

The battle still rages along the whole line; but it is no longer a battle against malaria. Malaria we know, we understand fully, we can beat down when we please. The battle which we are now fighting is against human stupidity. Those of us who have taken part in it—not too numerous—know what it has been. We have written and lectured *ad nauseam*; we have interviewed ministers, members of Parliament and Governors; we have appealed to learned societies; we have sought the support of distinguished people, and we have received—sympathy. We have reasoned, and been ridiculed; we have given the most stringent experimental proofs, and been disbelieved; we have protested, and been called charlatans. I think that not one of those young men who have pioneered this important work in the field has ever received thanks for his labours.

LIVE STOCK.

CATTLE BREEDING IN TRINIDAD.

(From the *Agricultural News*, Vol. VIII., No. 183, May 1, 1909.)

A Select Committee of the Agricultural Society of Trinidad and Tobago was appointed in July last to consider and report upon the question of cattle breeding in the colony, with special reference to securing the full benefit of stock at the Government Farm for breeding for beef, milk, and draft. The report of this Committee was published in the *Proceedings* of the Society for February last.

The average annual value of the cattle imported into Trinidad during the past five years has been £43,000, and the number 7,000. It will be seen, therefore, that there is abundant reason for making every possible effort to encourage cattle breeding in the colony, and provided the most suitable breeds are selected, the industry should be made to prove remunerative.

The Committee discuss in separate sections the raising of cattle for beef, for milking purposes, and for draft respectively. In breeding for beef, it is stated that the most suitable crosses hitherto obtained in Trinidad appear to have been those of the Hereford and half-bred Zebu, and the Red Polled and half-bred Zebu. The Red Polled has shown itself to be a satisfactory butcher's beast; it requires less fattening than many other breeds, and has the further advantage of being a good milker. There does not appear to have been much experience in Trinidad with the Hereford, which is the primary beef breed of cattle in England. A number of Hereford bulls have been imported, but these have all died shortly after importation—a fact which leads to the suggestion that all bulls should be imported as calves, and not as full-grown beasts. This breed has a great reputation in Jamaica, and has done well in Tobago. The animals fatten readily, and give beef of very good quality.

Opinion in Trinidad is divided as to the breeds of cows which are likely to be most successful for dairy purposes in the colony. The Committee, in their report, draw attention to the well-known and excellent milk-yielding qualities of the Jersey and Guernsey breeds. Cows of

these breeds have proved very satisfactory in the West Indies and fully kept up their high reputation. No mention is made of the Ayrshire, which is recognized all over Great Britain as a most economical and satisfactory cow for the dairyman. The Holstein or Dutch breed is another variety which in England as well as in many continental countries has earned a well-established reputation for yielding a large and profitable return of milk. The butter-fat content of this milk, however, is usually slightly below the average. Dutch cows have done well in Trinidad, and one practical cattle breeder recommended a cross between this breed and the Zebu, the result of which, in the opinion of the gentleman referred to, 'should make an invaluable dairy cow, combining the temper and milk-giving qualities of the Holstein with the hardy and healthy constitution of the Zebu.' The Red Polled and the Shorthorn breeds have also given satisfactory results as dairy cattle in Trinidad.

For draft purposes, it is evident that the Zebu breed of cattle is pre-eminently suitable. The further fact that they are so useful for crossing with other breeds renders this variety the most valuable yet introduced into the colony. Apart from the pure-bred Zebu, the animals resulting of a cross between this breed and the Hereford are also especially useful as draft cattle.

The Committee recommend that bulls of the breeds referred to, together with pure-bred cows, be imported, and that an effort be made to establish and maintain three separate classes of cattle especially suitable for beef, milk production, and draft respectively.

COMBATING MITES AND LICE ON POULTRY.

(From the *Agricultural News*, Vol. VIII., No. 176, January 23, 1909.)

The accompanying notes, dealing with lice and mites on poultry and in poultry-houses, supplement the information given on this subject in a recent number of the *Agricultural News* (November 14 last, p. 362). These notes, with others, have lately been issued in leaflet form by the United States Department of Agriculture:—

There are several varieties of lice that attack poultry. They subsist mainly on the feathers, and perhaps on the epidermal scales. They are found largely on the head and neck, under the wings and about the vent, and when present in large numbers they cause the fowls much discomfort. Pyrethrum, or Persian insect powder, powdered sulphur, and some of the various preparations on the market, such as the louse powders, are good in combating these pests. The hens can be dusted with one of these powders after they have gone to roost. Have the powder in a box with a perforated cover, grasp the fowl by the legs, and shake the powder well among the feathers. Dust at least three times, at intervals of about a week, in order to catch the lice which hatch out after the first dusting. The mites subsist on the blood of the fowls, and are not usually found on the bodies of the bird, except when at roost or on the nest. During the day they inhabit cracks and crevices of the walls, roosts, and nests. Sitting hens are often so annoyed that they are compelled to leave the nest in order to relieve themselves of these parasites. The free use of kerosene about the nests and perches is useful in fighting the mites. The walls of the house may be sprayed with kerosene, the operation being repeated every three or four days for two weeks. Insect powders are of little avail.

The following method has proved excellent in ridding houses of mites and lice when the weather conditions are such as to permit the birds being kept outside the house for five or six hours: Close all the doors and windows, and see that there are no cracks or other openings to admit air. Get an iron vessel and set it on gravel or sand near the centre of the house; place a handful of shavings in the vessel, saturate this with kerosene oil, and then sprinkle on the top of the shavings a quantity of sulphur, estimated at the rate of 1 lb. to every 90 or 100 square feet of floor space. Instead of using the shavings and kerosene, the sulphur can be saturated with wood alcohol. When everything else is in readiness, light the material and hastily leave the house. There is very little danger of fire when proper precautions have been taken to have plenty of soil beneath the vessel. Allow the house to remain closed for three or four hours, at the end of which time one can safely conclude that there are no living beings inside. Now throw all the doors and windows wide open, so as to drive out the sulphur fumes thoroughly, and then the fowls may be allowed to enter. Let them in one by one, and as each enters catch it and dust it well with insect powder, which will destroy the pests on the birds.

Tobacco dust is also good to use instead of insect powder. The birds and

house will have been freed from vermin for a time, but the eggs of the insects have not been destroyed, and in a week another swarm will be hatched out. Therefore, it will be necessary to repeat the operation once or twice before the pests are exterminated. After this, care should be taken to see that no strange fowl be admitted to the house or yard without having been thoroughly rid of lice, as one affected hen will contaminate all the rest.

APICULTURE.

NOTES ON BEE-KEEPING.

By A. P. Goonatillake.

Amongst the inmates of the hive, the Queen claims our first attention. She is the mother of all the inmates under normal conditions, the life of the colony and the source of its prosperity. She lives from three to six years, which is extraordinary when compared with that of her worker or drone offspring. With regard to the egg-laying powers, a queen is at her best in her second year. The queen is larger than the other inmates, viz., drones and workers, her body is more tapering, and her wings proportionately shorter, and when closed are folded across the body. The colour of her body is generally more decided, although varying to a degree with different queens of the same race. Her tongue is shorter than those of the workers, as also the sting, which is short and curved, and seldom used except in combat with a rival. Her legs are longer than those of the workers, of dark brownish colour, and are minus the pollen baskets provided on the legs of the worker. The queen's sole duty and concern is the reproduction of her species. She mates but once in her life, and this takes place outside the hive, generally when she is three to six days old.* Her food is of a rich nutritious character, and is supplied her by the workers. During the height of the season the queen lays up to 3,000 eggs a day. When her body is dissected some important peculiarities are observed, a knowledge of which is absolutely necessary, accounting as it does for some apparently curious phases of bee culture.

Situated in the abdomen and taking the place of the large air sacks found in the worker are two large ovaries or egg chambers, having tubes brought to a junction like the letter Y; this is the channel carrying the eggs to the ovipositor. In the region of the junction just referred to is a small spherical chamber called the spermatheca, which receives the male element at time of copulation, and which is sufficient to fertilise millions of eggs. The queen has power to lay eggs that will produce workers or drones at will. It is now known that an egg which is destined to become a worker, receives in its passage to the ovipositor a minute quantity of the fertilising agent stored up in the spermatheca just spoken of. On the contrary, if the queen wishes to produce drones the egg passes direct from the ovaries to the cell prepared for its reception, and thus by a process known as parthenogenesis a drone has a mother but no father. By this we understand that, should a young queen fail to become impregnated, she must inevitably become a drone breeder only, or if through injury to the spermatheca or exhaustion by reason of old age, she will only be able to lay drone eggs. Notwithstanding all the noble qualities that have been attributed to the queen, she is little more than an egg-laying machine to be cared for and valued as long as she can be of service to the stock; but when exhausted through old age or no longer able to fulfil the duties of her position, she is speedily superseded without ceremony, although for several months, perhaps, after her successor has taken over her duties, she is allowed to live as a pensioner. We have known the mother and daughter to live peaceably together in one hive for a number of months, both laying during this period. In some instances we have found two queens in wild hives too.

The Drone.—The drone is the male, and cannot well be mistaken for either queen or worker. He is a dark burly looking insect larger than the worker, and broader than the queen. He flies out during the warmest part of the day, at which time the virgin queens usually go out for their wedding flight. In flying he makes a peculiar buzzing sound quite unlike the noise made by the worker, and much less musical than the tone produced by the queen. The drone has very large compound eyes meeting at the top of the head and crowding the three simple eyes below; he has no sting, his tongue is shorter, and he has no wax secreting organs. The drone is fre-

* "Gleanings in Bee Culture" gives instances where fertile queens take their mating flight more than once.

quently spoken of in Africa as a water-carrier, but this is not so, nor does he gather honey or pollen. Like the queen, he has no pollen basket. He is entirely dependent on the workers for sustenance. There has been much speculation as to the duties performed by the drone, but as far as is known at present his sole duty, if not the only function, is that of continuing his race. In most districts drones are called into existence at the commencement of the swarming season, and may be ruthlessly expelled at the close. He is, so to say, a tenant at will, and may be ejected at any time according to the fancy of the workers. It is nothing unnatural if drones are allowed to live on throughout the year, which they frequently do where stores are abundant and the supplies not altogether suspended. We can with care keep drones all the year round. Queenless hives and those having fertile workers, although weak in stores, instinctively tolerate drones until provided with a laying queen.

THE WORKER.—The worker, or neuter, as she is frequently called, is really an undeveloped female, having only traces of the generative organs found in the body of the queen; a few can lay drone eggs under special circumstances, and these are called fertile workers, to which we shall presently allude. To the worker, the bee most diminutive in size, devolves the entire work and administration of the hive. There may be from twenty to fifty thousand workers in a good stock, so, "many hands make light work."

Nectar gathering, collecting pollen, wax secreting, comb building, brood rearing, storing honey and pollen in the various cells, feeding the queen, the ventilation of the hive, removal of the dead from the vicinity of the hive, the defence of the colony against intruders, keeping the hive clean and tidy, and numerous other duties are performed by the workers. The worker is provided with a longer tongue than either the queen or drone, and a beautifully aranged organ it is, allowing the owner to adapt it to the ever-varying depths and surfaces of flowers, and also for many other duties for which it is required in the hive. The worker has two stomachs, the stomach proper and the honey sac. Under the body between the abdominal segments are situated small wax pockets, which furnish the wax for comb building. The sting of the worker is straight and barbed, which make its extraction very difficult when deeply inserted. At the base of the sting is a poison bag furnished with muscles for injecting the poison. The smell of the poison is pungent and easily discernible. The posterior legs of the worker are provided with indentations and stiff hairs, upon which the gathered pollen is carried to the hive: these are called pollen baskets.

SCIENTIFIC AGRICULTURE.

SOIL INOCULATION.

(From the *Agricultural News*, Vol. VIII., No. 184, May 15, 1909.)

Agricultural literature has of late years included numbers of papers and reports on the subject of 'soil inoculation.' This term is applied to the various attempts that have been made to increase the crop-yielding power of soils by the introduction of bacteria which are known to be the cause of the nodules frequently observed on the roots of leguminous plants, and which are capable of assimilating free nitrogen from the atmosphere, that can be utilized as food by the plants in whose roots the bacteria live.

Practical agriculturists have for generations past been well aware of the fact that the growth of a leguminous crop such as peas, beans, alfalfa, etc., results in an increase in the crop-yielding capacity of the land cultivated, although it is only within comparatively recent years that a satisfactory explanation of the matter was brought forward. One of the early observers in respect to this subject was a Frenchman, Boussingault, who, as the result of weighing and analysing the crops grown on his own farm throughout six separate courses of rotation, was able to state definitely that from one-third to one-half more nitrogen was removed in the produce than was supplied in the manure. He observed, too, that the gain of nitrogen was particularly large when clover or other crops of the same family were grown.

Investigation work in relation to the manner in which leguminous plants obtained the supply of nitrogen was undertaken by a number of experimentors, but the credit of carrying out the researches which ultimately cleared up the whole matter belongs to two German scientists, Messrs. Hellriegel and Wilfarth, who published their results in

1886. These results demonstrated, conclusively, that leguminous plants were capable, under certain conditions, of obtaining and utilizing nitrogen from the atmosphere. It was further shown that this nitrogen assimilation was dependent upon the production of nodules on the roots of the plants. In later research work it was found that the root nodules were full of bacteria, which were the evident agents by which the free nitrogen was appropriated, and to these the name *Pseudomonas radicicola* was given. Other observers have since confirmed the results obtained by Messrs. Hellriegel and Wilfarth. Although these have been fully established, it may be added that the exact details of the whole process by which the nitrogen of the atmosphere is first assimilated by the bacteria and afterwards taken over and utilized by the plant not yet clearly understood.

The importance of the whole question is indicated by the large quantities of nitrogen which a leguminous crop is frequently enabled to withdraw from the air, even in the course of a single season, through the agency of the bacteria obtained in the nodules on its roots. As examples, it may be mentioned that in experiments carried out at the New Jersey Experiment Station, a crop of crimson clover was found to have added over 200 lb. of nitrogen per acre to the land in one year, while trials with velvet beans have shown nitrogen gains amounting to 213 lb. per acre in Alabama, 172 lb. in Louisiana, and 141 lb. in Florida.

In the light of the knowledge thus accumulated on the subject, the question naturally suggested itself to investigators as to whether the co-operation of leguminous crop and nitrogen-gathering bacteria might not be more extensively utilized in enriching the soil and increasing its crop-yielding capacity. With this object, therefore, a number of preparations for inoculating the soil, all containing the bacteria *Pseudomonas radicicola*, have, at different times, been placed on the market, and a good deal of experimental work has been carried out in the United States, Germany, Canada, and in England. The value of inoculation under certain circumstances has undoubtedly been indicated, but, speaking generally, the results have so far—for different reasons—been distinctly less promising than was at one time anticipated.

So long ago as 1887, some inoculation trials were undertaken in Germany. In this case, the land under experiment—reclaimed moor-land—was dressed with soil from a field which had previously borne flourishing legume crops. The results were successful, and eminently encouraging, and the example thus set was speedily followed in many districts. In view of the expense of carting soil over long distances, and of the danger of introducing weeds or plant diseases, this method was, however, soon substituted by the introduction of pure cultures of the nitrogen-gathering bacteria, put up in a convenient form for inoculating either a quantity of soil, or of the seed about to be sown.

The first preparation of the kind introduced on a commercial scale was placed on the market about 1895 by a German experimentor, Nobbe. It was known as 'Nitragin,' and consisted of pure cultivations of the *Pseudomanas* organism on a gelatine medium. 'Nitragin' was extensively tested both in Europe and America, but the results, on the whole, were not at all satisfactory. This failure was generally believed to be due to the unsuitable nature of the medium (gelatine) on which the bacteria were grown, and when this was changed a greater degree of success was attained. Another scientist (Hiltner) brought forward a method of cultivating the bacteria on agar jelly, while Moore introduced the still greater change of sending out the bacteria contained in cotton wool, which had been soaked in liquid cultures and afterwards dried. This preparation is added to a large bulk of water, with which the seed to be inoculated is treated before sowing. Moore's preparation was used in a very extensive series of experiments carried out by the United States Department of Agriculture in 1904. The results were very conflicting, but, on the whole, were unfavourable, although slight increases of crop were noticeable in many cases as the result of inoculation. Probably many of the failures noticed were due to lack of skill in preparing, handing, and employing the cultures. Culture preparations are still sent out by the United States Department of Agriculture, but they are now put up in liquid form, enclosed in hermetically sealed bottles.

In 1907, Professor Bottomley, of London, brought forward a new preparation of nitrogen-fixing bacteria for inoculation purposes, to which the name of 'Nitro-bacterine' was given. This was tried in numbers of experiments, but its introduction into the soil appeared to have little influence on the yields of the various leguminous crops treated. Sample cultures were obtained by this Department and by one or two estate owners for trials with various crops in the West Indies (including sugar-cane,

since Professor Bottomley devised special preparations, which he hoped would be useful not only with legumes, but with plants of other orders as well). The experiments made are reported upon on page 151 of this issue. It will be seen that while inoculation had no influence on the returns obtained with cowpeas at Antigua, the crop yields of woolly pyrol showed, in the case of one estate at least, considerable increase as the result of treatment. The results at Grenada also show one or two points of interest. Inoculation of sugar-cane at Antigua and Barbados had no effect whatever.

There are undoubtedly certain conditions under which inoculation of the soil with nitrogen-fixing bacteria may prove to be of very considerable value, but on the majority of cultivated lands, which have already borne leguminous crops, inoculation is likely to prove beneficial only if the bacteria introduced belong to a more vigorous race of nitrogen-gatherers than those normally present in the soil, or are specifically adapted to the peculiar crop to be grown. In this connexion it may be mentioned that it has not yet been fully decided whether nitrogen-fixation is carried on by more than one species of soil bacteria, or whether the bacteria which are associated with the various leguminous crops all belong to the species *Pseudomonas radicicola*. Points of similarity and slight points of difference are observed in organisms from different plants, and it would appear that if all are of the same species, there are a number of varieties of this species in existence. Evidence has been brought forward in support of the belief, held by many investigators, that the bacteria, when grown continuosly in association with one kind of leguminous crop only, become in time so modified as to be capable of giving the best results with that crop alone. At any rate, a greater degree of success has in many cases been obtained when each species of legume is directly infected with bacteria from nodules taken from other plants of the same species.

The most notable instances of success in soil inoculation that have so far been recorded have naturally been obtained on lands which have not previously borne a leguminous crop, more especially on virgin soil newly broken up, or on heath or bog land lately reclaimed. The presence of suitable quantities of lime and mineral manures are necessary for success, and must be provided, if normally deficient in the soil. In East Prussia very large areas of barren sandy heath land have been reclaimed and made valuable for agricultural purposes by working on this principle. Dressings of basic slag and kainit were applied to the soil, and after preliminary inoculation, crops of lupins have been repeatedly grown, and ploughed in. As a result, the nitrogen content of the first 8 inches of land has been raised from 0·027 to 0·177 per cent. in the course of twenty-five years, while it has also become proportionately richer in the mineral constituents of fertility.

SPRAYING FOR WEED DESTRUCTION.

(From the *Agricultural News*, Vol. VIII., No. 178, February 20, 1909.)

Spraying with various chemicals has in many cases been found to be the best means of destroying certain pestilent weeds. This method of destruction is especially worthy of adoption when the weed in question occurs over extensive areas, is of vigorous growth, and reproduces itself readily by vegetative means. Cheapness of the chemical employed is an essential factor in the economic success of the method.

In England and other European countries, spraying with a solution of copper sulphate is frequently adopted for the destruction of 'charlock,' a pestilent and vigorous weed which occurs largely in fields of wheat, oats, and barley, at an early stage of the development of these crops, and tends to choke out their growth. This method, which was first adopted about ten years ago, has proved both successful and economical. The 'charlock,' which possesses broad, rough leaves, and is allied to the mustard plant (*Brassica alba*), is destroyed, while the growing corn suffers little or no injury.

Another example of the application of spraying methods to weed destruction comes from the Malay States. In that country large areas of land are covered with what is known as 'lalang' grass (*Imperata arundinacea*). This is a creeping weed, with underground stems, which rapidly propagates itself by vegetative means as well as by seed, and quickly covers the ground with its thick, coarse growth. Slow-growing crops are checked out, and cattle refuse to eat the dry, coarse lalang. Digging out the weed proved to be a costly and unsatisfactory method, but experiment has lately shown that the lalang can be got rid of by spraying with a solution of arsenite of soda. The leaves are all killed within a comparatively short time, and are either turned into the ground, or allowed to rot on the

surface. In the latter case, the dead vegetation acts as a mulch, and prevents evaporation of moisture. Not only lalang, but also other weeds, more especially those presenting a large and flat surface to the spray, were found to be readily destroyed by the solution.

The price of the chemical is the chief item in the cost of the spraying work. This price amounts to about 6*d.* per lb., including freight. The solution can be applied by means of any of the ordinary sprayers on the market.

In the Malay States the arsenite solution was used on land monopolized by the lalang grass and not applied to the weed growing among cultivated crops. The object was to clear the land in a cheap and efficient manner before bringing it under cultivation, and the maximum cost for freeing from weeds is mentioned as about 2*s.* per acre, while usually it does not reach half this figure. It will therefore be seen that this method might best be adopted in clearing waste land.

Since the soda arsenite is so destructive in its action, it is probable that it would not be advisable to use it in spraying weeds occurring in a cultivated crop, as it appears more than likely that the latter would also be injured. In any case, experiments should first be made on a small scale.

NEW SOURCES OF NITROGEN.

(From the *Gardeners' Chronicle*, XLV., 1, 154, Feb. 6, 1909.)

Since the investigations of Liebig, Boussingault, Lawes and Gilbert, during the first half of last century, into the nature and sources of the elements necessary for the nutrition of plants, the great importance of an adequate supply of nitrogen has become fully recognized by all who are concerned with the cultivation of the land. Among plant-food constituents nitrogen may be said to take first place, being at once the most costly, and, under the ordinary conditions which prevail in the garden or on the farm, the most effective element for increasing the yield of all kinds of crops. Without the constant addition of an abundant supply, either in the form of organic material such as dung, or as nitrate of soda or other chemical fertilizer, the cultivation of field and garden produce rapidly becomes unprofitable.

All kinds of plants with the exception of those belonging to the leguminous class, take up the nitrogen which they require from the soil in a combined state, almost entirely as a nitrate of lime, soda, or some other base. Even before the nitrogen in the farmyard manure and other organic substances becomes available for the nutrition of crops, it is changed into nitrates by the activity of special soil bacteria.

Unfortunately, from all cultivated land there goes on a constant drain of this element, and not more than 75 per cent. of it added in manures is ever recovered in the crops, even under the most favourable conditions. On account of the soluble nature of nitrates they are rapidly washed out of the soil into the drainage-water, especially in winter, when no plants are present to absorb them, and a certain amount is decomposed with the formation of free nitrogen gas, which escapes into the air and is lost. Large amounts are removed in the crops, and as these or the products derived from them are transported into towns and other areas away from the land which produces them, it will be readily understood that soils which have been cultivated for centuries have been undergoing a process of gradual exhaustion of one of their most important constituents. The demand for supplies of nitrates, which has increased to an enormous extent both in the Old and New Worlds during the last 30 or 40 years, becomes intelligible after consideration of the points just mentioned, and the spread of intensive methods of cultivating the land is destined to increase the demand. About 1830 nitrate of soda was introduced from Chili and Peru, and since that date it has tended to stave off the nitrogen famine and keep up the crop returns. In 1860 it was assumed that the deposits would last for more than 1,500 years at the rate at which the fertiliser was then being used, but an increase of population and a great extension of cultivated areas along with increased intensive management of the soil have falsified the prediction. The world's markets are now consuming 1½ millions of tons of nitrate of soda per annum, and the exhaustion of the present source of supply is well within sight; a few decades will see an end of it. Temporary checks to the development of a nitrogen famine have been made by the addition of sulphate of ammonia to the list of fertilisers supplying this all-important ingredient, but no permanent alteration in the growing need for it could be expected from either of these materials.

That the food supply of the increasing population is bound up with the discovery of some new source of nitrogenous plant-food has become more and more

evident, and the existence of a practically unlimited amount of nitrogen in the atmosphere has fired the imagination of scientific men and stimulated persistent research into the question of the conversion of the free nitrogen of the air from its inert gaseous condition to a combined state suited to the needs of all crops,

The efforts to utilise this constituent of the atmosphere for the production of a nitrogenous plant-food on an economical scale have been crowned with success during the last three or four years, and at the present moment two new fertilizers are being placed on the market. One of them, calcium cyanamide, introduced under the trade name of "Nitrolin" is obtained by heating the pure nitrogen of the air with calcium carbide (the well-known material used in bicycle lamps) in an electric furnace; the nitrogen is absorbed by the carbide, and calcium cyanamide is produced. It is a fine powder, somewhat like basic slag, containing 20 per cent. of combined nitrogen, an amount equal to that in the best samples of sulphate of ammonia. It contains also a certain amount of lime, which is of benefit upon soils deficient in that material. In comparative trials with sulphate of ammonia and nitrate of soda upon Potatoes, Cabbages, Wheat, Mangels, as well as many garden crops, it has proved itself an excellent substitute for these manures. Since it is liable to check germination and damage seedling plants, it is best applied to the land 10 to 14 days before sowing seeds. The application may be made at the rate of 1 cwt. to 2 cwt. per acre, and when intended for use as a top-dressing it should be mixed 10 to 14 days before application with one to four times its weight of finely-divided soil. Like sulphate of ammonia, it does not act immediately upon crops, but must first be nutrofied or changed into a nitrate in the soil. It is adapted for use in all kinds of land, with the exception of those of an acid character or on light sands where the nitrifying bacteria are are not abundant.

The other product whose nitrogen is obtained from the air is calcium nitrate, a compound which is certain to become a formidable rival of all nitrogenous fertilizers, and, with "Nitrolin," is destined to have a far-reaching effect on the production of the world's crops. As far back as 1786 Cavendish discovered that the combination of the nitrogen and oxygen of the air can be brought about by the passage through it of an electric spark. This fact has never been lost sight of by chemists and engineers, but its practical and economic application have not been attained until recently. Several methods of bringing about this chemical combination on a large scale are now known, but the process which is apparently giving the best results is that devised by Birkeland and Eyde in Norway. The union of the gases occurs in a specially-constructed electric furnace, the oxides of nitrogen being afterwards passed into water, and the nitric acid formed subsequently combined with limestone. The nitrate of lime produced is sent into commerce 75-77 per cent. pure and containing 13 per cent. of nitrogen—about 2 per cent. less than in nitrate of soda. It is a brownish substance without smell, very soluble in water and as active as nitrate of soda upon plant growth. Experiments both in this country and abroad have shown that its nitrogen is quite as efficient, unit for unit, as that in the latter manure, and on soils deficient in lime it is likely to be more effective.

The prophetic statement by Sir William Crookes that starvation may be averted through the laboratory, and his suggestion, that the production of electricity at a cost sufficiently low to make the manufacture of nitrates from the air a commercial success may be attained through the utilisation of water power, are now being realised. The danger of a nitrogen famine and its consequent bearing upon the growth of human food cereals has been removed by these new achievements of the chemist and engineer.

The first factory for the manufacture of calcium cyanamide was erected at Piano d'Orte in Italy, but others have been established in Austria, Germany and France. The North-Western Cyanamide Co.'s works are situated at Odda, near the southern end of the Hardanger Fjord in Norway, and from this centre the new fertiliser will be supplied to the United Kingdom and its colonies and the greater part of north-western Europe.

Nitrate of lime is manufactured by the Norwegian Hydro-Electric Co. at Notodden, in Telemarken, the energy for the electrical power being obtained from a neighbouring waterfall. The output of the factory is at present about 20,000 tons per annum, but in less than two years, when a new factory will be in working order, with power derived from the Rjukan Falls—the largest in the country—the production will be increased to 100,000 tons per annum.

The question of cost will largely determine the use to which the new fertilisers will be put. The unit of nitrogen

in each is practically the same as in nitrate of soda and sulphate of ammonia, but the new products have a valuable asset in them in the form of lime, and with new improvements in the process of manufacture and a reduction in the cost of production a substantial lowering of price may reasonably be expected. In the meantime we can confidently recommend both of these products for trial in the garden during the coming season.

MISCELLANEOUS.

LITERATURE OF ECONOMIC BOTANY AND AGRICULTURE.

By J. C. Willis.

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IMPERIAL TRAINING IN HORTICULTURE.

(From the *Gardeners' Chronicle*, Vol. XLV., No. 1159, March, 1909.)

The task of cultivating the land of the Empire is becoming more and more one for trained horticulturists. The increasing complexity of modern life causes an increase in the number of commodities indispensable to that life. The natural or agricultnral rate of production being too slow to meet the demand, it has to give place to intensive methods which are essentially horticultural in their character.

Our point of view is strikingly illustrated by the custom which is growing up in various tropical regions of holding what are called "agri-horticultural shows" in the place of the purely agricultural and purely horticultural shows common in our own country. Though the word agri-horticnltnre is ungainly enough, it is expressive of the modern trend of development of the science of the cultivation of the earth.

In treating of the training of horticulturists for the Empire, we have not primarily in mind the training of men for service in the Government Botanical Gardens at home or abroad. Kew provides, in a manner not to be rivalled elsewhere, the technical education and practical experience necessary for the men who are to fill official posts of this kind, and in the present, as in the past, Kew men are giving an excellent account of themselves in all parts of the civilised world.

But even with respect to such posts as these more might be done than is at present attempted. For botanical gardens are becoming also experimental stations. Now, the director of an experimental station requires special training of a kind not yet available at Kew. In such a man practical skill in the science of horticulture should be combined with a knowledge of the methods of experimentation.

We are concerned for the moment with the need for training young men who possess small available capital, or, in default of capital, a fair endowment of energy, and who are willing to emigrate to one or other part of the Empire in order to till the soil.

It would be well for the Empire if the home country were engaged in preparing and sending out year by year colonists who had a knowledge of the methods of horticulture already implanted within them.

The reader may ask: Is it likely that any system of training at home will be of

real value in the novel conditions which the emigrants are likely to encounter? Will it not be better to send them as boys to the new countries, there to learn their work by experience?

When the diverse conditions under which horticulture is carried on are considered; when the climate of Canada, severely continental in type, is contrasted with the insular climates of our tropical island possessions; when regard is paid to the varied produce of the Empire, it may well seem as though the experience to be gained at home could be of but little service to the emigrant in his new surroundings.

Nevertheless we believe that to draw such a conclusion would be to make a profound mistake. The successful horticulturist learns by experience to control, in as large a measure as is humanly possible, the conditions under which his plants are growing. He knows, consciously or unconsciously, the ideal conditions for certain plants, and proceeds sagaciously to provide the closest approximation to those conditions. His plants, like all plants, have simple wants —water and air, sunlight and warmth, together with small quantities of soluble compounds such as nitrogen and phosphorus. Some plants, it is true, need more water or light than others. But the peculiarities of the plants which grow at home are as wide as those that grow anywhere.

Therefore, the knowledge he has gained here will stand him in good stead abroad. He will make mistakes; but so he does at home. He will be confronted with special difficulties; but so he will be wherever he may practise his craft.

The training which he had at home would, moreover, unless it were of an inadequate kind, teach him caution; for it is only the half-trained who think they have nothing to learn.

It would be a good thing if the men going out from these shores to grow fruit in British Colombia, rubber in Malaya, or tea in Ceylon, were men trained in the general, universal principles of horticulture, and not men, trained or untrained, selected haphazard by the careless hand of chance.

For this purpose no small horticultural college, with its good intentions and necessary limitations, would suffice. Such a horticultural station as that contemplated by the Innes bequest might, without detriment to home interests which should be its first care, form a centre for such Imperial training. What is wanted is an Imperial Institute of Horticulture; an institution amply endowed and supported by the constituent members of the Empire. Such an institution would not, of course, be a teaching body only; it would investigate as well as instruct. Nor would it exist solely for the service of the colonies and dominions of the Empire; it would benefit also the home country. An institution of the kind would not only train men to go abroad and train men for home horticulture, but it would attract men from the Colonies themselves. To it would come men from the east and from the west in order that they might learn the latest word of horticultural wisdom.

This is no place to discuss detail; as, for instance, whether anyone should be admitted to study at the Imperial Institute of Horticulture before he had worked for a term at the practice of horticulture, or whether the manual and mental parts of the work should be carried on simultaneously—we refrain from using such words as "practical" and "scientific" in antithesis. To do so is ridiculous; for if science is not practical, and if practice is not scientific, then both are nonsense.

The proposal thus outlined in briefest fashion may seem, even to those who sympathise with the aspirations suggesting it, too bold to be likely of realisation. It is true that such a scheme would require the expenditure of a large sum of money. But when the importance and the magnitude of the work which such an institution would perform are considered, it cannot be doubted that the money would be well expended. Other industries, great and imposing, it is true, but, nevertheless, of lesser magnitude than those of agriculture and horticulture, have their "Charlottenburgs." In this country we are still without a Chair of Horticulture at any of the Universities, and it is not long since the first Chair of Forestry was established. Why, at the next Imperial Conference, should not such a proposal as that outlined here be given consideration?

NEW PLOUGH FOR SIND.

By G. S. Henderson.

(*Illustrated.*)

(From the *Agricultural Journal of India*, Vol. IV., Pt. 1, January, 1909.)

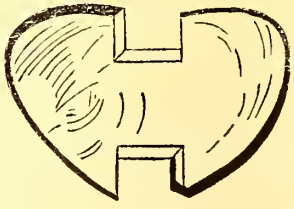
On the Mirpurkhas Farm the following form of wooden plough has been found to do very good work. It is a slight modification of the indigenous wooden plough of Egypt. With perennial irrigation, where the land can always be

softened by water, it is a most efficient implement. Along with the leveller or "ghasabiah" it forms practically the whole stock-in-trade of the Egyptian cultivator. It has there held its place in the estimation of the cultivator against repeated attempts to introduce iron ploughs. The broad share deals effectively with weeds. The sharp-pointed Sindhi plough, on the contrary, is very apt to miss a considerable number of these, and in particular often fails to pull up the very troublesome creeping stems of "kull" and other plants.

Construction.—The pole is made of jarrah or any long grained wood and should be about 11 feet long and 4 inches broad and 2½ inches thick. The body is of babul wood, about 3 feet 6 inches long. The body and pole are dove-tailed into each other and fastened by a moveable bolt. The handle is fastened to both ends of the body, leaving the pole free to move on removal of bolt. Half way along the body an iron bar is fastened through the body, and goes through the pole. At the top of the iron are several holes by means of which the angle between body and pole can be regulated. The share is 6½ inches broad and spear-shaped, being fastened to end of body. The total cost of construction, including labour and material, is between Rs. 7 and Rs. 8.

Demonstrations of this implement are being arranged to be held in each Taluka town, when a sufficient supply of implements has been made.

Ridging.—For ridging up land a piece of wood of the following shape is inserted behind the iron bar :—



General Use.—The cost of ridging with the plough is very considerably cheaper than the same work done by hand with the "kodar." With a couple of ploughings, any land should be in sufficiently good tilth for ridging up. It is essential for the proper growth of Egyptian cotton and all other crops that the land must be in good tilth and properly cultivated, and this can be done probably better by means of this plough, than by employing an expensive English iron one. It has an advantage over the latter, in that the cultivator takes to it naturally. He has no difficulty in holding it as he has with the two-handled plough. On the other hand, there are several makes of light one-handled iron ploughs having wooden poles. These have, however, been found quite unsuitable for this class or hard soil, it being almost impossible to keep them in the ground.

In comparison with the Sindhi plough, though slightly heavier in draught, it will do a half more work and go a couple of inches deeper. The dimensions given above were adopted for ploughs worked by cattle of the Cutchi or Guzerati type. The sizes may, however, be varied to suit smaller cattle.

THE CHINESE METHOD OF ROTATION OF CROPS AND RECLAMATION OF LALANG LAND.

BY DR. LIM BOON HENG.

(From the *Agricultural Bulletin of the Straits & F. M. S.*, Vol. VII., 10th October, 1908.)

The most conspicuous evidence of the folly of the Government leasing of agricultural land in the Straits Settlements, is the existence of enormous tracts of valuable land, now overgrown with lalang (*Imperata cylindrica*) and consequently thrown back upon the Government as a practically valueless asset. It generally takes about ten years for such land to be covered with good secondary forest growth. Had the Government stipulated that every acre of land should be replanted with some permanent trees, or had they made the conditions of the lease such that it would be more profitable to cultivate such land than abandon it and take up new virgin jungle, we might have had all these waste areas beautifully afforested or at least yielding some returns. Fortunately since the cultivation of Para Rubber has proved to be a success, even with tapioca as a catch crop—thanks to the pioneer work of Mr. Tan Chay Yan at Bukit Asahan—now the Malacca Rubber Plantations Limited, the Government or the officials of the land office, are quite awake as to the necessity of preventing tapioca and other lands going into waste under lalang.

It may therefore be of considerable importance to planters to know that Chinese vegetable growers practise an economical method of reclaiming lalang land. In discussing this, it may be interesting also to note in passing their system of manuring, for the lalang is not merely weeded out but is also choked out by a careful rotation of valuable crops. As a rule, it costs about twenty dollars at least to clear one acre of lalang. The Chinese, who pay their farm hands at $12-$15 a month, manage to get good returns within two years by reclaiming lalang land, and to convert it into a useful vegetable garden.

The fact that this system has succeeded so well in Singapore, where the soil is generally poor, argues that it should be more successful, wherever the soil is more fertile. It must be admitted that without the use of farm-yard or human manure this system cannot succeed very well.

The essence of it may be explained in a few lines. The stems of the lalang are exposed by hoeing or deep ploughing, and removed by the rake and burned. The soil has to be turned up two or three times if necessary to remove the weed completely.

At the same time, the aid of nature is called in. Rapidly growing plants are planted at once in carefully manured beds. A struggle for existence is thus artificially introduced, and within three months or so, the patch of waste land is covered with green vegetables. The transformation is very impressive, but the steps require to be seen. The change affords a striking object lesson of the importance and value as well as feasibility of permanent cultivation of the soil.

But unfortunately in Singapore, cultivation of the soil is not profitable unless "night-soil" is utilised. Human excreta constitute the most efficient and at the same time the cheapest manure. The Municipal authorities evidently do not take the slightest interest in the utilisation of this refuse. They proposed an extensive scheme of casting it out to sea, and dumping it all into the deep ten miles off Singapore. Surely, when this was proposed, neither the Engineer nor the Medical Health Officer had in mind the state of vegetable cultivation in the Colony. The bulk of our population consists of people, whose food is principally a mixture of rice and vegetables. Without the night-soil removed from town the numberless vegetable gardens in the country must be abandoned. The result will inevitably be that vegetables will be grown in Johore and elsewhere—Rhio perhaps, and if there is danger in the use of such matter, the risks of infection will be increased, since our sanitary authorities cannot possibly control these foreign growers. It seems to us that the most useful method of disposal of excreta for this Colony—in view of the urgent needs of vegetable growers—is some scientific means of treating the manure in different depots in the country and then distributing it to the gardens. The risks of this form of manure carrying infection are not great, inasmuch as the night-soil is thoroughly fermented before it is put to the soil. One can easily conceive of its utilization in an appropriate manner without offending the taste of even the most fastidious.

Without some good manure, it is not easy to raise plants on such exhausted soil as forms the habitat of lalang as a rule. This much-maligned grass is in our opinion a friend to man in disguise. When the soil is composed principally of clay—and the surface humus has been all washed away, there are very few plants that can grow on it. But such land is sooner or later invaded by

lalang—whose underground stems penetrate deeply, and ramify in all directions. In this way the surface soil is broken up. As the grass grows up and dies down, a quantity of organic debris begins to collect, and in course of time affords a suitable nidus for the growth of shrubs and forest trees. If it were not for the lalang, the afforestation of such waste land would take a very long time indeed. But unfortunately lalang is very treacherous to get rid off, and is very fatal to the growth of young plants. There are very few tree seedlings that can survive in the struggle for existence. Even such hardy trees as the coconut palms become sallow and sickly and eventually stunt and die. Para Rubber trees make a brave struggle, and if there is enough humus in the soil, soon outgrow the lalang, and if closely planted may force the latter to die out on account of the shade.

The method of stamping out the lalang must be carried out systematically. As soon as an acre or so of the land has been ploughed, holes 3′ × 3′ are dug out at about 20′ intervals, and filled with manured humus, the seeds of *labu*—the bottle gourd, or of other species of quickly growing cucurbitas are sown. The young plants quickly spread all over the ground. In the meantime, the ground is turned up a second time, the stems of lalang being thrown up, collected and burned.

In a couple of months the gourd has flowered and withered away. Again, the land is hoed, and then as a rule some atropaceous plant such as chillies or egg-plants are planted in beds. The ground is by this time well freed of lalang, and is scrupulously weeded. The young plants, replanted usually from a nursery, are manured with a diluted mixture of ripened excreta and water daily or thrice weekly. The chillies are well nigh exhausted about four months from the time of planting. They are generally succeeded by a crop of sweet potatoes, after which the land is allowed to lie fallow for a couple of months. Then the weeds are ploughed up and used as green manure mixed with farmyard compost.

Briefly the order may be stated categorically.

1. Chillies.
2. Some leguminous plant.
3. Sweet potatoe.
4. Tapioca.

Indigo is a favourite leguminous plant to be cultivated. It requires very careful manuring, and generally yields three crops of cuttings—after which the land is allowed to rest for a few months.

By careful tillage and judicious manuring, these Chinese vegetable gardeners are able to make use of the poorest land available and to obtain good returns for their toil and investment. When lalang land has been thus reclaimed, it is not unprofitable to plant it up with rubber between the vegetable grown.

AGRICULTURAL CREDIT SOCIETIES.

(From the *Journal of the Board of Agriculture*, Vol. XV., No. 6.)

Agricultural credit societies or banks are combinations of small farmers or labourers formed for the purpose of raising capital to be advanced at a reasonable rate of interest to members requiring temporary loans for the purpose of reproductive undertakings. The small holder, the labourer with an allotment, the market gardener, or the small village tradesman may occasionally require a loan to enable him to make purchases on favourable terms of such requirements as live stock, seeds, manures or implements, and it is to meet this want that the establishment of agricultural credit banks has been urged in England. Among the peasant proprietors of the Continent, these co-operative loan societies have proved very successful, and in districts where small cultivators are sufficiently numerous there seems no reason why the methods which have proved successful elsewhere should not be adapted to meet local conditions in England.

Limited and Unlimited Liability.—There is, however, no one method which has been universally adopted abroad, and even as regards broad general principles, there exists the widest diversity. The continental societies may, however, be broadly divided into two classes, those with limited and those with unlimited liability of members. The latter type is perhaps the more largely developed, and it was on this basis that the two main systems of credit, called after their inventors the "Raiffeisen" and the "Schulze-Delitzsch," were first founded. The main features of banks of the "Raiffeisen" type are (1) that no shares are issued, the capital being raised by entrance fees, subscriptions and deposits, and loans bearing a fixed rate of interest; (2) that the liability of members is unlimited, every member being jointly and severally responsible for any losses that may be incurred by the society; (3) that the loans advanced by the societies are for reproductive purposes only, the borrowers being required to satisfy the managing committee that the object for

which the loan is required is one that affords a reasonable security for his being able to repay the loan at the date fixed; and (4) that the operations of the society are confined to a small area in order that the personal character and needs of applicants for loans may be known to the members and committee.

The collective liability of the members to the extent of their whole means arose partly from the fact that it was the only system on which such societies without means of their own could raise money to lend to their members, and also that at the time of their foundation it was the only system recognised by the German law. In some parts of Germany, however, the principle of unlimited libility has not been received with favour, and the explanation is to be found apparently in the distribution of the agricultural population. In districts where small peasant proprietors predominate, all of a similar station in life and not varying very greatly in wealth, the Raiffeisen principles have made great headway, but where farms of different sizes occur the various classes are disinclined to share on equal terms the burden of unlimited liability, and some form of limited liability has been preferred. It is possible for this reason that co-operative credit banks based on unlimited liability have up to the present made so little progress in England, while in Ireland, where there is a greater preponderance of holders of the same class, they have increased in numbers with considerable rapidity. It appears, for instance, that in 1907 there were only 15 agricultural credit societies in England and apparently none in Scotland, whereas there were 246 societies in Ireland, which had loans outstanding in that year to the amount of £50,164, and had a membership of 15,100. With an extension in the numbers of small holdings in this country, the opportunities for the establishment of credit banks are likely to become more numerous.

The agricultural co-operative credit societies formed up to the present are usually based on the principle of the unlimited liability of the members for the debts of the society, because this joint liability provides a security on which money can be borrowed at normal rates of interest. A community of small cultivators, who may wish to form a society of this kind are unlikely to be able to raise enough money among themselves to provide a sufficient capital to enable an institution of this sort to be founded on an independent footing. It has therefore been found necessary to work on the lines of the Raiffeisen banks, but in order that the societies may be maintained on a sound financial footing, it is in the highest degree essential that the importance of the two main principles of the Raiffeisen banks should be fully recognised.

Loans Granted for Reproductive Purposes only.—It is necessary in the first place that the societies should lend money for reproductive purposes only; such as, for example, the purchase of manures, feeding stuffs, cattle, sheep, pigs and poultry, the erection of buildings, glasshouses, &c. It must be remembered that borrowed money can only be utilised with advantage if the margin of profit obtained from its employment is higher than the rate of interest paid for it. The possibility of obtaining money on favourable terms constitutes one of the strongest arguments for co-operative banks, but it is necessary that the probablity of obtaining a higher profit from money thus obtained should be clearly shown. In this connection it may be noted that the Department of Agriculture for Ireland in its Annual Report for 1906-7 observes, "It is of the greatest advantage to the poor farmer to obtain a loan on easy terms if the money is properly applied to a reproductive purpose, but if the loan merely tempts him to increase his liabilities, without any ultimate prospect of finding himself in an improved position, it can but injure him."

Moreover, it is essential that the promissory note signed by the borrower should depend for its value not merely on the signature of the borrower and his sureties, but that it should have behind it, as it were, goods actually purchased with the money. Loans should never be granted for the payment of debts, nor is it desirable that loans should be renewed, or new loans granted, in the place of old ones which have not been discharged. The possibility of unfavourable seasons, unproductive crops and unsatisfactory prices should always be borne in mind.

Need for Limiting the Operations of each Society to a Small Area.—The second principle of importance in unlimited liability societies is that of confining their operations to a small area. It is obvious that where loans are granted on personal security an intimate acquaintance with the circumstances of each of the members and particularly of their character, for sobriety, honesty and integrity is absolutely necessary. This can hardly be the case if a society extends beyond the limits of, at the most, two or three parishes, but the need for limiting the area necessarily results in each individual society possessing but small powers of raising money.

Advantages of a Central Bank.—The drawbacks connected with this restric-

tion of the operations of the societies were recognised in Germany at a very early stage in the existence of the Raiffeisen banks, and the need was felt for a central institution which could borrow money on the collective responsibility of a number of societies, and also utilize any available balance in the hands of one society for the benefit of another. Provincial central banks were therefore formed, and these were again, in some cases, centralized in a still larger institution. At the present time the principle of a central bank may be said to be recognised in all the continental countries where co-operative credit has been at all developed, though there is some difference of opinion as to the methods on which it should be managed. In England an institution of this kind, known as "The Central Co-operative Agricultural Bank, Limited," has been registered under the Industrial and Provident Societies Act, 1893, for the purpose of financing the village co-operative credit societies affiliated to the Agricultural Organisation Society.

It is hoped that this bank will also enable the societies to overcome certain difficulties which have been experienced in dealing with their deposits. These deposits ought to form the principal from which their working capital is obtained, but it is pointed out in the report of the Agricultural Organisation Society for 1906 that if a large deposit is offered, the society may not be able at the moment to lend it out, and its only course is to pay it into its own account at the local joint stock bank, where, if it is earning interest at all, it is not earning as high a percentage as the society is obliged to pay for it, and the society accordingly loses. Again, if the deposit is withdrawable at short notice, the society cannot without risk of being placed in a difficulty lend out the money for long periods. The newly-established bank will place the societies in a better position in this respect, as it will be prepared both to receive surplus deposits from local societies and to advance money to them when required.

Methods of forming a Society.—An agricultural credit bank of this type may be registered as a "specially authorised society" under the Friendly Societies' Act, 1896, on application to the Registrar of Friendly Societies, 28, Abingdon Street, S.W. This application must be made on a special form to be obtained from the Registrar, and must be accompanied by two printed copies of the proposed rules. No fee is payable for the registration of an agricultural credit society. The rules must comply with the Act, and it may be noted that the Act provides that the loans must be confined to members; that the rules must fix a maximum for any loan made to a member on personal security, and that no loan can be made which, together with moneys owing for the time being by the member to the society, exceeds £50; that the total amount held at any one time on deposit cannot exceed two-thirds of the total sums for the time being owing to the society by the borrowing members; and that no member can hold an interest in the funds exceeding £200. Where, however, such a "specially authorised society" divides no profit among its members and watches over the application of the money lent, it is entitled under the Societies' Borrowing Powers Act, 1998, to make a rule authorising it to borrow money from any person whether a member or not; otherwise the Friendly Societies' Act requires the "loan fund" to be formed by contributions or deposits from members only, subject to the limitations menticned above.

A form of rules has been prepared by the Registrar of Friendly Societies for the purpose of asssisting specially authorised societies in complying with the provisions of the Frendly Societies Act so far as they relate to such societies. A set of model rules specially adapted to agricultural credit societies is also issued by the Agricultural Organisation Society, Dacre House, Dacre Street, Westminister, S.W., and this society will assist in the formation of these agricultural credit banks.

These rules prescribe the terms of membership and provide for the appointment of the committee, trustees, treasurer and secretary, for the holding of meetings, the keeping and auditing of the accounts and other matters.

The rate of interest on loans and the date of repayment are not fixed by law, but the model rules of the Agricultural Organisation Society provide that when a loan is granted it may be for some fixed term not exceeding twelve months, or it may be repayable in instalments at intervals of one, two, four, six or eight weeks, or three months; the interest to be charged for loans not made repayable by instalments is not to exceed 6 per cent. per annum; the interest on deposits is not to exceed 4 per cent. per annum; no profit, bonus or dividend of any kind is to be divided among the members, and any surplus after payment of the cost of administration is to be carried to the reserve fund.

While loan societies, registered as specially authorised societies, cannot claim exemption from stamp duty, priority of claim against the estates of their officers in event of death or bankruptcy, agricultural credit societies have

the advantages of those sections, but the other special privileges of the Friendly Societies' Act, 1896, are not extended to either.

Assistance of County Councils in the Formation of Credit Banks.—The position as regards the formation of credit banks has been somewhat modified by the Small Holdings and Allotments Act, 1907, which authorizes a county council to promote the formation or extension of co-operative societies having for their object the provision or the profitable working of small holdings or allotments, and under this definition societies for the purpose of credit banking are specifically included. The county council, with the consent of, and subject to, regulations made by the Local Government Board, may assist such societies by making grants or advances, or may guarantee advances made to the society upon such terms and conditions as the Council may think fit.

Number of existing Societies.—Only a few of these societies exist in England at present, but they appear to be doing a useful work among small cultivators, village tradesmen, allotment holders and the rural labouring classes.

According to the Report of the Chief Registrar of Friendly Societies for 1906 (Part A, Appendix N, Sections I-IX), the following twelve societies were registered in England on the 31st December, 1905. The Muskham Credit Society, which was registered in 1904, was dissolved in 1906:—

	Date of Establishment.	Number of Members.	Amount of Funds.
			£
Cambridge—			
Cottenham Agricultural Credit Society	1896	20	11
Hampshire—			
Hedge End Agricultural Credit Society	1896	32	219
Bedford—			
Clophill Credit Society ...	1900	16	—
Lincolnshire—			
Spalding and District Credit Society	1904	98	203
Friskney Credit Society ..	1904	27	12
Scawby Agricultural Credit Society	1894	28	42
Norfolk—			
Whissonsett Small Holders Credit Society	1905	18	26
Wiggenhall Agricultural Credit Society	1896	46	
Suffolk—			
Laxfield Agricultural Credit Society	1894	10	10
Warwick—			
Grandborough Village Bank...	1895	7	165
Worcester—			
Far Forest and District Credit Society	1903	11	50
Castle Morton Agricultural Credit Society	1895	19	1

Some account of the operations of these societies will be found in the publications of the Agricultural Organisation Society. The Wiggenhall Agricultural Credit Society, for example, is described in the Society's *Journal* for March, 1908. This society, which has been in existence twelve years, was established with the assistance of a local landowner, who provided part of its first capital by placing the sum of £50 on deposit. It also raised capital by taking deposits of 1*s.* and upwards from members to bear interest at 4 per cent. up to £20, and at 3 per cent. when over that amount. In December, 1906, the funds of the society amounted to £138, of which about £68 were deposits, while the outstanding loans amounted to £114. The purposes for which loans have been granted are buying horses and ponies for tradesmen and small holders, buying live stock, manure, seeds, repairing green houses, &c. One member has been able to make a small holding with the assistance of a loan from the society, together with his deposits over a number of years. The present membership is 47.

Another society at Friskney advanced money in 1905 to the amount of £97 for such purposes as the purchase of a cow and a pig, of implements on the borrower taking a larger holding, and to assist a man who was purchasing his holding. The Hedge End Credit Society granted loans amounting to £180 for the purchase of seeds and manure. None of the societies appear to have suffered any losses.

Societies with Limited Liability.—Where the principle of unlimited liability is felt to be unsuitable, or unnecessary for the purpose of raising capital, a society "for carrying on the business of banking" with limited liability can be established under the Industrial and Provident Societies' Act, 1893. The share capital must be transferable and not withdrawable, and no member can have any interest in shares exceeding £200. Application for registration must be made on a special form to the Chief Registrar of Friendly Societies, 28, Abingdon Street, S.W., and the fee is £5 unless the society adopt certain model rules.

THE TREATMENT OF WEEDS IN PERMANENT CROPS.

BY F. A. STOCKDALE.

(From the *Journal of the Board of Agriculture of British Guiana*, Vol. II,, No. 4, April, 1909.)

What is the most economic treatment of weeds in plantations of such crops as cacao, coffee, oranges, limes, or rubber?

This is a question that has often been raised by cultivators, and is one that has received attention at the hands of experimenters.

In the tropics, vegetative growth is exceedingly rapid, and consequently the expenses of weeding crops that take some years to reach the full-bearing stage are often enormous, and not infrequently they represent a very large proportion of the total expenses of the plantation. It is possible that this expense can be reduced, without sacrificing in any way the health and vigour of the permanent crops or without damaging the condition of the soil? This question is particularly of importance to the cultivator who is commencing with small capital, who therefore desires to raise a plantation of healthy trees as economically as possible. Nor is it without interest to the capitalist, especially when low prices render it necessary to reduce expenditure. Further, it is a matter that should receive the attention of the peasant proprietor.

In planting a large number of permanent crops, it is the common practice to interplant with such temporary crops as bananas, plantains, cassava, etc., in order that some returns may be obtained during the first few years of growth. This practice may be considered a satisfactory one from a weeding point of view, for the shade afforded by the temporary crops considerably reduces the number of weeds, and therefore reduces expenses. Sooner or later, however, it is necessary for the growth of the permanent trees that the greater portion of the provision crops should be removed. Weeds now become more numerous and require more constant attention, and again the question arises as to what is the most economical method of dealing with weeds in order that the best results may be obtained from the permanent crops.

METHODS.

The different methods that may be adopted may here be grouped under separate sub-heads. It is possible to practise the following methods :—

(*a*) *Clean weeding*, either by means of constant use of the fork and hoe or by means of the hoe alone.

(*b*) *Clean weeding and cutlassing*—by clean weeding a circle around each tree, and allowing the weeds in the intervals to grow, to be cutlassed down at definite intervals.

(*c*) *Cutlassing*—by allowing the weeds to grow and to cut them down periodically with a cutlass, and either to use the weeds as a mulch around the trees or to allow them to remain where cut.

(*d*) *Green mulching*—by growing "smother crops" to kill out the weeds, to be cutlassed down periodically and allowed to rot on the ground.

The advantages and disadvantages of the different systems may now be briefly discussed :—

(*a*) *Clean weeding.*—This is carried out by forking the land between the trees at definite intervals and by weeding with a hoe. Sometimes the forking is dispensed with. The hoe alone is then used, and the weeds are either buried or allowed to rot in heaps. This system is adopted on many cacao plantations in the West Indies, where a thorough forking is given once in every two or three years, and the weeds that grow during the intervening years are cut up with the hoe and buried in small pits dug throughout the fields, while the fields are lightened by "cracking" the earth with the fork without turning the soil. On other cacao estates the forking is dispensed with and hoeing is practised, the weeds being buried in small pits, while on some lime estates where hoeing alone is practised the weeds are allowed to rot in heaps or are collected around the roots of the trees.

Thorough forking of the soil renders it more pliable and more easy of drainage, and prevents the drying of the lower soil by capillary action. It also lets in light and air into the soil and generally improves the tilth. Against this it may be pointed out that as the land is denuded of any covering, a large amount of

SURFACE EVAPORATION

of moisture and of heat radiation takes place, while the "baking" effect of the tropical sun may have some injurious effect upon the normal bacterial action in the soil, whereby the dormant plant food is made available. Heavy rains, moreover, wash most of the finer soil particles and humus of the surface soil deeper down, and a large quantity of this valuable soil may eventually find its way into the drains, especially if the land is not quite flat. If the permanent trees have grown to a fair size, the forking may produce heavy root pruning, that may set them back for some time. Further, forking is a particularly costly process, as also is hoeing and the burial of weeds. The use of the hoe alone is not generally to be recommended, for it has usually been found that only the top soil is scraped, that a hard surface is left beneath this, and that the weeds are rarely satisfactorily dealt with.

(*b*) *Clean Weeding and Cutlassing.*—This method consists of keeping a circle clean around the trees, with forkings at definite periods, and allowing the weeds

to grow in the intervening spaces. This method is a compromise between clean weeding and cutlassing solely. The forking around the trees must cause some injury to the roots, but this may be offset by the fact that the roots of the trees are kept free from the injurious effects of weeds, and if the grass that is cutlassed down is applied as a mulch on these cleaned circles, loss of moisture by evaporation is prevented and the general tilth of the soil is improved. This mulch should not be placed immediately around the trunk of the tree, for such a practice has been shown to be injurious, but it should be spread evenly in a circle commencing at least 18 inches or 2 feet from the trunk, and as the trees grow this circle should be enlarged. On the other hand, care must be taken that a hollow is not left around the tree, in which water may accumulate.

(*c*) *Cutlassing.*—On many estates, where the rainfall is heavy and the growth of weeds luxuriant, the weeds and grass are allowed to grow, and they are cutlassed down at periodical intervals, and either used as mulch around the trees or allowed to rot on the ground where cut down. This system is adopted in many young cacao plantations, and in a very large number of the Dominica lime cultivations. By this surface covering of weeds, the soil is prevented from being "washed," and it is protected from the harmful effects of the sun. The conditions are also favourable to the bacterial action for the liberation of plant food; for the moisture content and temperature of the surface soil are favourable to bacterial growth. Against this, it is urged that the soil will suffer in tilth from lack of proper tillage, and that the soil will be improperly aerated. The cutting down of the weeds, however, causes some of them to die, and the drainage and aeration that results from the death of the roots is a matter that must receive consideration. The weeds and grass use up some of the plant food that should be available for the trees, but it is

NOT PERMANENTLY REMOVED

from the soil, as the grass and weeds are cut and left on the soil to increase the humus in the soil. Again, they evaporate directly from their leaves a large quantity of soil water, and thereby cause a loss of moisture directly from the soil. It has, therefore, practically to be decided whether the benefit derived from the surface covering, sufficiently offsets the loss of moisture and plant food through the weeds and grass; particularly when the reduction of the expenses over the clean weeding method is borne in mind.

On many of the lime and cacao estates in Dominica this from of culture has been practised for a considerable time, and the results have during the last ten years been closely investigated by Dr. Watts, now Imperial Commissioner of Agriculture, and it has been found that the physical condition of the soil generally remains good. The permanent crops grow well under this system, and "wash" of the soil is prevented, even on the steepest slopes. The application of the cut grass and weeds as a mulch around the roots of the tree is probably better than allowing them to rot where cut down, as it affords direct protection and good addition where the feeding roots of the permanent trees are situated. This system is practised in the coffee cultivation at Onderneeming School farm, under the direction of the Department of Science and Agriculture, and on some sections is assisted by bringing in additional material for mulching purposes. It has been quite satisfactory, and increased crop returns have been obtained. The weeds or mulch must not, however, be packed too close to the trunks, or otherwise they keep the trunks too damp and favour the growth of fungus diseases and the presence of insect pests.

It is well here to add a

WORD OF WARNING

in regard to this system. Para grass should on no account be allowed to grow in permanent cultivations. It should always be dug out and burnt, or otherwise it is likely to become a troublesome pest. It was once observed on a cacao plantation in St. Lucia that the removal of Para grass was not properly done from the beginning, with the result that larger expenditure was incurred in doing it at a later date, when its injurious effects were being felt by the cacao trees. The difficulty of getting rid of this pest when once established is well known in this colony, and care should therefore be taken with it.

(*d*) *Green mulch.*—This system consists of growing cover crops, preferably of leguminous plants, to smother out the weeds. These crops are cut down just as they commence to flower, and allowed to remain on the soil as a mulch. The advantages of this system over the cutlassing of weeds is that control is kept of the growth between the permanent crops, that the leguminous crops benefit the soil by their root nodules, and that a larger amount of material is available for mulching purposes. Less cutting down is needed, and the expenses thereby reduced, but against this reduction must be placed the cost of the seed and the cost of establishing the cover crops. For cover crops purposes a

number of leguminous and non-leguminous plants have been experimented with. Cow peas, Bengal beans, and *Canavalia ensiformis* have been found suitable in the West Indies, while *Crotalaria striata*, *Mimosa pudica* and *Desmodium triflorum* have given good results in Ceylon and the East.

In the foregoing, the chief merits and disadvantages of the different systems have been briefly discussed, and it now remains to ascertain what is to be advised for the conditions pertaining in this colony.

EXPERIMENTS.

Experiments by the Department of Science and Agriculture to ascertain what plants are the most suitable for the cover crops in this colony will be made, and the different systems will be given a trial at the various experiment stations distributed throughout the colony. Those plants which are found to be suitable, will, during the first year, be saved for seed, in order that quantities may be available for distribution to the planters and others that are desirous of carrying out experiments in their cultivations. Seed of *Crotalaria striata*, from Ceylon and also locally grown, is to be sent for trial at the Rubber Station at Isorooro, in the North-West, while other local plants are to be under careful investigation at the various experimental fields. Among these will be tried *Crotalaria retusa*, *Canavalia ensiformis*, *Canavalia obtusifolia*, *Canavalia gladiator*, *Phaseolus semierctus*, Bengal beans, Iron cow peas, and Wooly Pyrol, while experiments will also be carried out with others that give promise to be suitable for the purpose of green mulching.

One of the most interesting points in connection with the green mulch system has recently been raised by Mr. J. B. Carruthers, in his Annual Report for 1907, as Director of Agriculture in the Federated Malay States (shortly to take up duties in the newly organized Agricultural Department in Trinidad). By sowing seeds of such a plant as *Crotalaria striata* as soon as the land is felled and burned for rubber planting, and before the rubber plants are put in, the growth of weeds and under scrub is greatly prevented and expenses, therefore, considerably reduced. From this report the following extract has been taken, and may prove of interest:—"By far the best time to establish one of these plants at a minimum cost is directly the land has been burnt off. Having once got the plant established, the immediate necessity of putting the rubber in is over, since the fields do not get any worse, but rather better, for the reception of the rubber plants and the cost of cutting away the crotalaria, mimosa, or other plant to put in lines and holes is very little. The only weeding necessary is in case jungle trees or scrub sprout, and these can easily be noticed among the prevalent growth of a single plant and removed. No soil is lost from the beginning of the opening of the land, and the gain in this to the roots of the rubber plant is not to be neglected."

Correspondence.

"TROPICAL LIFE."

2nd June, 1909.

DEAR SIR,—Will you kindly note the particulars of the enclosed copy of "T. L." *re* a competition that we have started to encourage further research work on the Fermentation of Cacao, and report same in your publications, as I am most anxious for the Ceylon men to know of the competition, so that they can take part if they wish to do so.

Details have still to be arranged, and will be published month by month in the Journal (T. L.), but you can take it that we shall start officially next month (July) and close in December, 1910—giving 18 months in which to prepare the papers.

Further copies of this issue of T. L. will be sent with pleasure, if needed.

Thanking you in anticipation.

I remain, yours very truly,
(Signed) H. HAMEL SMITH

The tenth £5 just to hand, so I have at least the £50.

The following is an extract from *Tropical Life* which relates to the competition in question.—(ED.):—

THE FERMENTATION OF CACAO:

PROPOSED PRIZE FUND TO ENCOURAGE FURTHER RESEARCH WORK.

During the last twenty years several improvements have been introduced in the systems and methods employed to dry cacao, but as regards the fermentation planters still have much to learn. German and Dutch authorities have published accounts of their investigations

in this line, and have added to the scientific knowledge of the subject. What we now require is to have a popular scientific treatise drawn up in English on the fermentation and drying of cacao; one that will fully explain the why, when, and where of the biological and other changes that take place in the beans. Such a treatise will, we consider, encourage the planters to continue the experiments on a large scale, and by adopting the method found to give the best results they will be able to assure an improvement in the quality, colour, appearance, and more even break of their beans. It should also enable small peasant and other proprietors, as in the West Indies, to turn out from numberless small plantations large bulked shipments of cacao, as similar in appearance as is the case with the exports from Bahia, San Thomé, the Gold Coast, &c., cacao that can be depended upon to turn out to type, and not show a marked difference in appearance in every few bags.

In order, therefore, to encourage further research work on the lines stated, and to ascertain exactly what changes (together with their causes, and whether these changes occur during the fermenting process only, or whilst being dried) take place in the cacao bean between the time that it leaves the pods until it is shovelled into the bag for export, the Editor of Tropical Life has much pleasure in heading a list of donors of £5 each towards a prize fund for the best treatise on the subject, the said treatise to be competed for on terms as shall be agreed upon by the various subscribers as soon as the list is closed.

It is hoped to raise at least £50. Whether one or more prizes will be awarded depends on the decision of the subscribers and the amount raised. At present three promises have been received, and two more from the Continent seem likely to follow. Those already subscribing include :—

The Editor of *Tropical Life*.
Messrs. Cadbury Bros.
Die Indische Mercuur.

PARA CURVATING SEEDLINGS.

Gikiyanakanda, Neboda,
April 26th, 1909.

Sir,—I have proved to my entire satisfaction that this trouble is due entirely to nurseries being badly laid down.

The seeds should be laid flat with the crease up or down, and should be only just covered with fine soil. On no account should there be any depth of soil over the seed.

Nursery work is one which amply repays constant and absolutely reliable supervision.

If your correspondent will bear in mind what I have said above, I can promise him a nursery free from turned roots.

The same thing applies when laying down a Tea nursery. Unless you make it impossible for the seed, in either case, to be rolled into a hole which is *said to be* a certain depth, the result will be disappointing. Of course, some few roots turn from contact with small stones, but the percentage of these would be very very small, provided the nursery site has been suitably chosen and properly worked.—Yours faithfully,

GEORGE H. GOLLEDGE.

[The subject of the above letter is dealt with in The Circulars and Agricultural Journal of the Royal Botanic Gardens, Ceylon, Vol. IV., No. 17. Mr. Petch informs us that in his experiments the depth at which the seed was planted did not seem to have any effect, and that the position of the seed is the chief factor concerned.—Ed.]

EFFECT OF FLOODS ON TAPPED RUBBER TREES.

Tavoy, 4th June, 1909.

Sir,—Will you or any of your readers be so good as to tell me the effects of floods on tapped rubber trees? Does the water getting into the cuts cause rot and thus injure the tree? In the case of jute trees, which are tapped by Burmans for use as birdlime, rot is thus caused and the tree often eventually dies. Would such evil effect be probable in the case of Para rubber? The flood water level in part of my grant is, every three or four years, 6′ to 8′. This would entirely submerge the tapped surface of trees planted in these lowlying parts. What would be the effect on the tree? Any information will be gratefully received.—Yours truly,

BURMAH.

[No injury is likely to be caused unless the tapping had been severe and the bark split away from the wood, but the result will depend, to some extent, on the time of immersion. Apart from this slight risk, immersion should do the trees good, and probably increase the subsequent flow of latex. Trees in the low-country of Ceylon, which have been tapped by the herring-bone system and are submerged 4 to 6 feet at every rise of the river, have not been affected, and the bark heals well.—M. K. B.]

MARKET RATES FOR TROPICAL PRODUCTS.

(From Lewis & Peat's Monthly Prices Current, London, 7th July, 1909.)

	QUALITY.	QUOTATIONS.
ALOES, Socotrine cwt.	Fair to fine ..	85s a 90s
Zanzibar & Hepatic ,,	Common to good ..	40s a 85s
ARROWROOT (Natal) lb.	Fair to fine ..	2½d a 4d
BEES' WAX, cwt.		
Zanzibar Yellow ,,	Slightly drossy to fair ...	£6 12s 6d a £6 15s
Bombay bleached ,,	Fair to good	£7 10s a £7 12s 6d
,, unbleached ,,	Dark to good genuine ..	£5 15s a £6 10s
Madagascar ,,	Dark to good palisb	£6 10s a £6 15s
CAMPHOR, Japan ,,	Refined	1s 6½d a 1s 9d
China ,,	Fair average quality ...	140s
CARDAMOMS, Tuticorin	Good to fine bold	1s 9d a 2s 2d
	Middling lean	1s 4d a 1s 6d
Tellicherry	Good to fine bold ..	1s 9d a 2s
	Brownish ..	1s 3d a 1s 7d
Mangalore ,,	Med brown to fair bold	2s a 3s 5d
Ceylon, Mysore ,,	Small fair to fine plump	1s 4d a 2s 8d
Malabar ,,	Fair to good ..	1s 4d a 1s 6d
Seeds, E. I. & Ceylon ,,	Fair to good	1s 7d a 1s 8d
Ceylon Long Wild ,,	Shelly to good ..	6d a 1s 6d nom.
CASTOR OIL, Calcutta ,,	Good 2nds ..	3d
CHILLIES, Zanzibar cwt.	Dull to fine bright ...	35s a 40s
CINCHONA BARK.—lb.		
Ceylon	Crown, Renewed	3⅝d a 7d
	Org. Stem	2d a 6d
	Red Org. Stem	1¾d a 4½d
	Renewed	3d a 5½d
	Root	1½d a 4d
CINNAMON, Ceylon 1sts	Good to fine quill	10d a 1s 4d
per lb. 2nds	,, ,,	9d a 1s 2d
3rds	,, ,,	7½d a 11½d
4ths	,, ,,	6½d a 9½d
Chips, &c..	Fair to fine bold	2⅞d a 3½d
CLOVES, Penang lb.	Dull to fine bright pkd.	1s 1d a 1s 3d
Amboyna ..	Dull to fine	8d a 9d
Ceylon ..	,, ,,	7½d a 9d
Zanzibar	Fair and fine brigbt	4½d a 4⅝d
Stems ..	Fair	1¾d
COFFEE		
Ceylon Plantation cwt.	Medium to Bold	nominal
Native	Good ordinary	nominal
Liberian ,,	Fair to bold	43s a 55s
COCOA, Ceylon Plant. ,,	Special Marks	65s a 73s
	Red to good	60s a 63s
Native Estate ,,	Ordinary to red	40s a 54s
Java and Celebes ,,	Small to good red	30s a 85s
COLOMBO ROOT ,,	Middling to good	15s a 17s 6d
CROTON SEEDS, sift. cwt.	Dull to fair	30s a 35s
CUBEBS ,, ,,	Ord. stalky to good	80s a 90s
GINGER, Bengal, rough ,,	Fair	30s
Calicut, Cut A ,,	Small to fine bold	60s a 85s
B & C ,,	Small and medium	52s a 60s
Cochin Rough ,,	Common to fine bold	38s a 42s
	Small and D's	37s 6d
Japan ,,	Unsplit	32s
GUM AMMONIACUM ,,	Sm. blocky to fair clean	25s a 60s nom.
ANIMI, Zanzibar	Pale and amber, str. srts.	£16 a £18
	,, ,, little red	£13 a £15
	Bean and Pea size ditto	75s a £12
	Fair to good red sorts	£9 a £13 10s
	Med. & bold glassy sorts	£7 a £9 5s
Madagascar ,,	Fair to good palish ...	£4 a £8 15s
	,, ,, red ...	£4 a £7 10s
ARABIC E. I. & Aden ,,	Ordinary to good pale	25s a 32s 6d nom.
Turkey sorts ,,		27s 6d a 47s 6d
Ghatti ,,	Sorts to fine pale ...	20s a 42s 6d nom.
Kurrachee ,,	Reddish to good pale ...	20s a 30s ,,
Madras ,,	Dark to fine pale ...	15s a 25s ,,
ASSAFŒTIDA ,,	Clean fr. to gd. almonds	85s a 100s
	com. stony to good block	25s a 75s
KINO	Fair to fine bright	6d a 9d
MYRRH, picked cwt	Fair to fine pale	80s a 115s
Aden sorts ,,	Middling to good	55s a 70s
OLIBANUM, drop ,,	Good to fine white	40s a 50s
	Middling to fair	25s a 35s
pickings ,,	Low to good pale	10s a 20s
siftings ,,	Slightly foul to fine	13s a 15s
INDIA RUBBER lb.	Fine Para bis. & sheets	6s 8d
	,, Ceara ,, ,,	6s 6d
Ceylon, Straits,	Crepe ordinary to fine..	6s a 6s 10d
Malay Straits, etc.	Ball Block ..	7s
	Plantation to fine ..	5s 1d a 5s 4d
Assam	Plantation	4s 10d a 5s
	Fair II to good red No. 1	4s a 6d
Rangoon	,, ,,	3s 2d a 4s

	QUALITY.	QUOTATIONS
INDIARUBBER (Contd.)		
Borneo	Common to good	1s 6d a 3s 6d
Java	Good to fine red ..	2s 6d a 4s 6d
Penang	Low white to prime red	2s a 3s 3d
Mozambique	Fair to fine red Ball ...	3s 8d a 5s
	Sausage, fair to good ..	3s 6d a 4s 10d
Nyassaland	Fair to fine ball ...	3s 8d a 4s 7d
Madagascar	Fr to fine pinky & white	2s 10d a 3s 8d
	Majunga & blk coated ..	2s 3d a 2s 9d
	Niggers, low to good ..	1s 6d a 2s 2d
	Ordinary to fine ball ..	3s 2d a 4s 6d nom
New Guinea	Shipping mid to gd violet	3s 5d a 3s 10d
INDIGO. E.I. Bengal	Consuming mid. to gd.	3s 1d a 3s 4d
	Ordinary to middling	2s 9d a 3s
	Oudes Middling to fine	2s 6d a 2/8 nom.
	Mid. to good Kurpah	2s 3d a 2s 6d
	Low to ordinary	1s 6d a 2s 2d
	Mid. to fine Madras	1s 5d a 2s 4d
	Pale reddish to fine	1s 11d a 2s 4d
	Ordinary to fair	1s 8d a 1s 10d
	,, ,, good pale	1s 7d a 2s 1d
	Wild	5d
	UG and Coconada	5s a 5s 6d
	Jubblepore	4s 9d a 6s 9d
	Bhimlies	4s 9d a 7s
	Rhajpore, &c.	4s 6d a 6s 3d
	Calcutta	5s a 5s 6d
	64's to 57's	1s 3d a 1s 6d
	110's to 65's	4½d a 1s 2d
	160's to 115's	4d a 4½d
MACE, Bombay & Penang per lb.	Ordinary to fair fresh	12s a 14s
Java	Ordinary to good	9s a 11s 6d
Bombay	,, ,,	6s a 6s 6d
MYROBOLANES, cwt	,, ,,	6s 3d a 8s
Bombay ,,	Fair merchantable	4s 5d
	According to analysis	3s 10d a 4s 2d
Bengal ,,	Good flavour & colour	2d a 2½d
NUTMEGS— lb.	Dingy to white	1½d a 1¾d
Bombay & Penang ,,	Ordinary to fair sweet	2½d a 1s
	Bright & good flavour	1s 0½d a 1s 1d
NUTS, ARECA cwt.		
NUX VOMICA, Cochin	Mid. to fine not woody..	10s 12s
per cwt. Bengal	Fair ...	10s
Madras		,,
OIL OF ANISEED ,,		
CASSIA ,,	Fair ..	3½d
LEMONGRASS ,,	,, to fine bold heavy ..	3½d a 4d
NUTMEG ,,	,, ...	3½d
CINNAMON ,,	Dull to fine	3d a 3½d
CITRONELLE ,,	Fair to fine	5⅝d a 8d
ORCHELLA WEED—cwt	Fair	5d
Ceylon ,,	Fair	4½d
Madagascar ,,	Fair to fine bright bold	—
	Middling to good small	—
PEPPER - (Black) lb.	Dull to fine bright ..	—
Alleppee & Tellicherry	Ordinary to fine bright	—
Ceylon	Dull to fine	15s a 16s 6d
Singapore ..	,, ,,	14s a 15s
Acheen & W. C. Penang	,, ,,	11s 6d a 13s 6d
(White) Singapore ,,	Ordinary to gd. soluble	50s a 80s nom.
Siam ,,	Good to fine bold green	5d a 7d
Penang ,,	Fair greenish	3½d a 4½d
PLUMBAGO, lump cwt.	Commonspeckyand small	1½d a 2½d
chips		
dust	Small to bold ..	37s a 97/6 nom.
SAGO, Pearl, large ...	,, ..	36s a 80s
medium ..	,, ,, ...	£7 a £8 2s 6d
small ...	Fair to good ..	£5 5s a £9 7s 6d
SEEDLAC cwt.	Sorts	25s a 30s nom
SENNA, Tinnevelly lb.	Mid. to fine bl'k not stony	11s a 13s
	Stony and inferior ..	4s a 5s
SHELLS, M. o'PEARL—		
Egyptian cwt.	Small to bold ..	12s 6d a 26s
Bombay ,,	Pickings	6s a 24s
Mergui ,,	Fair	18s
Manilla ,,	Finger fair to fine bold	17s a 19s
Banda ,,	Bulbs [bright	14s a 15s
TAMARINDS, Calcutta...	Finger	16s
per cwt. Madras	Bulbs ..	13s 6d
TORTOISESHELL—		
Zanzibar, & Bombay lb.		
	Small to bold ..	9s a 16s
TURMERIC, Bengal cwt.	Foxy & reddish ,,	8s 3d a 12s
Madras ,,	Lean and inferior ...	8s 3d a 8s 9d
Do. ,,	Fine, pure, bright	2s 11d
Cochin ,,	Good white hard ...	46s
VANILLOES— lb.		
Mauritius .. 1sts		
Madagascar ... 2nds		
Seycbelles ... rds		
VERMILLION ..		
WAX, Japan, squares		

THE SUPPLEMENT TO THE

Tropical Agriculturist and Magazine of the C. A. S.

COMPILED BY A. M. & J. FERGUSON.

No. 2.] AUGUST, 1909. [VOL. V.

TOBACCO CULTIVATION IN CEYLON.

THE PROPOSED EXPERIMENTS.

The possibility of improving Tobacco cultivation in Ceylon has been brought prominently before successive Governors of the Colony—more particularly by administrators and residents in the Jaffna Peninsula. The late Mr. R. W. Ievers, when G. A. in the Northern Province, more than once recommended in his administration reports the appointment of an expert to introduce among the local cultivators new methods of growing and curing their leaf in order to suit it to the European markets. The tobacco industry at one time was a considerable one. Latterly it has declined. Parts of Southern India, formerly the best customers for the Ceylon product, have commenced to supply their own demands and naturally the Ceylon growers have suffered from the competition. With the decline in the trade the cry for an expert has become more insistent, and there is now every prospect of something being done in the way of experiment to decide definitely, once and for all, whether Ceylon tobacco can be improved and whether it can be improved to such an extent as will ensure a demand being created for it on its merits in the East and in Europe. Private enterprise in the past has been responsible for many attempts—conducted by Europeans—to improve the Ceylon product and to start an industry in it, but these have all been abandoned after a time, presumably as failures. Tho reasons why these experiments failed, have not been placed on record. It may have been for reasons quite apart from the suitability of Ceylon soil and climate for growing a better class tobacco. Government have never been persuaded to officially experiment. The present experiment will certainly be productive of much more satisfactory and definite results than any experiment in the past. It will be conducted systematically and the results will be carefully recorded. The experiment must be regarded as an exceedingly important one. It is being conducted more or less with public money and will be the crucial and final test of whether Ceylon tobacco is capable of being improved to a degree likely to create a flourishing and remunerative industry. It is well, therefore, that the Agricultural Society should consider well on what lines the experiment is to proceed—so that full advantage may ultimately be taken of it before launching out on any scheme. The difficulty which faced the Agricultural Society at their last meeting was as to the qualifications of the "expert," or rather "Superintendent of Tobacco experiments" to be employed. The Committee apparently are prepared to accept an officer, with some knowledge of agricultural science, who would spend the first year of his appointment in acquiring a knowledge of the methods of cultivating and curing tobacco employed in Ceylon, India, and such other countries as the Committee may decide; the second and third years to be spent in carrying out experiments in the growing and curing of tobacco at the Experiment Station, Maha Iluppalama. The advice of the expert would also be available to cultivators in other parts of the island. They do not regard previous experience in tobacco cultivation and curing as a *sina qua non*. We can see no reasonable objection to this; although personally we think, if it were at all possible to get the services of an experienced tobacco planter from Sumatra, to work out the above programme, the results would be infinitely more satisfactory. We certainly think it would be an advantage if the gentleman selected had some previous knowledge of tobacco and its cultivation and curing on the most up-to-date principles. The meeting thought otherwise, however, and finally adopted a suggestion made by Mr Bernard Senior that an officer be selected to

undergo a training for one year at some College or place to be decided by the Committee, the Committee paying his tuition fees, boarding fees and reasonable travelling expenses ; on his obtaining a certificate of proficiency the officer shall be offered an appointment under Government at a salary to be fixed by the Committee, and such appointment to be for three years. In the meantimo tho matter is referred back to the Tobacco Sub-Committee for further consideration and report. Mr. W. D. Gibbon at the meeting expressed surprise that R27,500 was to be spent on this experiment. All we can say is that if it succeeds in assisting the industrious cultivators of tobacco in the North and elsewhere to improve the cultivation of their leaf and restore a once flourishing native industry to its pristino prosperity, the money will have been well spent. In conclusion we can only say that we sincerely hope that the experiment will now be set on foot without unnecessary delay and that the results will eventually prove satisfactory. Jamaica, after experiment, succeeded in growing Sumatra tobacco which sold for from 6/- to 7/- per lb. May Ceylon be equally successful. Sir Henry Blake was of opinion Ceylon could not grow a good covering leaf like Sumatra: Mr. Gibbon reiterated this opinion, but the contemplated experiment alone will definitely decide whether Ceylon can or cannot produce a satisfactory covering leat.

Meeting of the Board of Agriculture.

QUESTION OF ENGAGING AN EXPERT.

The Acting Governor's Views : Report Referred Back to the Committee.

A special meeting of the Board of Agriculture was held at the Council Chamber on July 5th, to consider the following resolutions of the Tobacco Sub-Committee brought up by Mr R H Lock at the annual meeting of the Society held on June 8th :—

1. That Government be requested to re-vote the sum of R7,200, or such larger sum as they may be disposed to grant, in three equal instalments, in the Estimates for 1910, 1911, and 1912. The money to be placed at the disposal of the Board of Agriculture for the payment of part of the salary of a Tobacco Expert.

2. That arrangements be made for allowing the sum of R27,500 appropriated for the purpose of carrying out tobacco experiments, to be drawn upon during the period October 1st, 1909—September 30th, 1912, or such longer period as may be determined.

3. That an officer be appointed locally on a salary of R3,000, rising by instalments of R500 to R4,000 per annum, and reasonable travelling expenses, who shall be called the Tobacco Expert to the Ceylon Board of Agriculture.

4. That the appointment be made for three years from October 1, 1909 ; and that the officer appointed be required to refund the first year's expenditure made on salary and travelling expenses in the event of failure to serve for the full period, unless in the event of illness, reasonable sick leave being allowed.

5. That the appointment be made by the President of the Society on the recommendation of the Tobacco Committee, with the approval of the Board, and that the officer be under the direct control of the Committee through its Chairman, the Organising Vice-President of the Society.

6. That the expert spend the first year of his appointment in acquiring a knowledge of the methods of cultivating and curing tobacco employed in Ceylon, India, and such other countries as the Committee may decide ; the second and third years to be spent in carrying out experiments in the growing and curing of Tobacco at the Experiment Station, Maha Iluppalama. The advice of the expert would also be available to cultivators in other parts of the Island.

7. That the expert be required to pass an examination in colloquial Tamil at the end of the first year's service.

H. E. the Acting Governor, Sir Hugh Clifford, K.C.M.G., presided and the others present were: —The Hon. Messrs H L Crawford, C.M.G., Bernard Senior, I.S.O., L W Booth, S C Obeyesekere, A Kanagasabai, Sir S D Bandaranaika, C.M.G., Messrs W D Gibbon, J Harward, R H Lock, A N Galbraith, J D Vanderstraaten, W A de Silva, G W Sturgess, Tudor Rajapakse, Gate Mudaliyar, Daniel Joseph, Dr. H M Fernando and Mr. C Drieberg (Secretary.)

The History of the Proposals.

Mr. R H Lock—called upon by the President —said he would briefly trace the history of the proposals to consider which that meeting had been called, and he hoped that after his doing so, they would agree with the proposals made by the Sub-Committee. At a meeting of the Society on May 4th, 1908, the following Committee, on the motion of Mr. Kanagasabai, was appointed to consider what action, if any, the Society should take in the improvement of the local tobacco industry, and to submit an estimate of cost of such measures as it may recommend:—Dr. Willis, Mr. F H Price, Mr C J C Mee, Mr. M Kelway Bamber, Mr. Edward Cowan, Hon. Mr. A Kanagasabai and Mr. R H Lock. After several meetings a good deal of discussion, and a special visit by Mr. Drieberg and Dr. Willis to the Jaffna Peninsula to go into the question, the Sub-Committee submitted its report at a meeting of the Society on October 5th, when a resolution, proposed by Mr Ferguson, was passed that a sum of R27,500 out of the balance estimated to be in the hands of the Society be reserved for an experiment in the growing and curing of tobacco for the foreign market. That having been resolved, the further business of the Committee was to consider the details and to say how the expenditure was to be carried out. He would briefly explain the reasons for the present resolution. The Sub-Committee concluded that the only way in which the tobacco industry could be enlarged into a thoroughly paying business was by adopting new methods of cultivation, especially in the curing and manufacture of the tobacco to suit the European and American markets. The question arose as to whether new markets could be got for the new produce. He met two gentlemen, who were Directors of the American Tobacco Co., and, although not interested in the cigar tobacco business, they expressed the opinion that in tobacco, as in other produce, they must send large samples. They would receive consideration and, if they were of good quality, would have a ready sale. The idea at first was to appoint a tobacco expert, who had experience of planting and curing in Sumatra, but the terms of the only available expert were beyond the means of the Society and the present alternative proposals were made. There was a good deal to be said for the latter as opposed to the other. The Committee, therefore, suggested that the gentleman appointed should have previous knowledge of

agricultural science and spend a year in getting up his subject, visiting other countries where tobacco is grown and on returning take charge of experiments at Maha-Illupallama. There were one or two reasons in favour of that proposal as against getting an outside expert. If the proposal was to commence a large tobacco estate such as in Sumatra, then it would be necessary to get an expert, but Ceylon was not Sumatra, and the object would be too ambitious as a good cigar leaf binder tobacco was probably beyond them. That was what the proposals amounted to. What the result would be it was impossible to say, but there were good prospects in tobacco planting on a large scale and in their dreams they saw a flourishing industry. There was one amendment he had to make, viz., the substitution of the words "Superintendent of the Tobacco Experiment" in place of the word "Expert." If His Excellency (the Chairman) as President put the case in a favourable light to the Officer Administering the Government, there was no doubt that Government would agree to the proposals. The rest of the resolutions explained themselves. With those few remarks he would propose the resolutions standing in his name.

Seconder's Speech.

Mr. J. D. Vanderstraaten—said he begged to second the resolutions, the more so as it was not intended in the first instance to cope with Sumatra. From his own slight experience in the growing of tobacco he could say there was great need for improvement in the tobacco leaves of the cigars smoked locally apart from tobacco exported. He had himself experimented and could speak of the unevenness of the curing and fermentation. If they were successful in learning how to cure properly for local consumption, then they would be able to export successfully. There was vast room for improvement in the local manufacture. He was told by Rev. Father Massier of Trincomalee that the tobacco from a garden in Trincomalee was purchased by one grower who exported it to Madras as a cover for cigars. If that was—and he had no reason to doubt that what Rev. Fr. Massier told him was—the truth, there was room in Ceylon for growing tobacco. He was told that tobacco could be very successfully grown in the North-Central Province. He believed there was a great future before tobacco in Ceylon and he had great pleasure in seconding the resolutions.

Mr. Gibbon's Horror of Experts.

Mr W D Gibbon:—I had great pleasure in listening to what the proposer of the resolutions said, but I regret I did not hear one word of what passed from Mr Vanderstraaten—(laughter); so if he said anything to contradict what I have to say he must remember it is not with any desire to contradict him, but I do not know what he said. But what is this expert? I think we are really tired of experts. We are full up with them; and the name of "expert" is a misnomer. We always meet with "expert opinion"; and sometimes, we find the expert a fraud—that is, his opinions are not worth anything. (Laughter.) Then as regards Sumatra tobacco. Your own experience of the place, Sir, will tell you that we can never grow Sumatra tobacco here. The Sumatra and North Borneo tobacco is a covering leaf quite different from the leaf we have in Ceylon. Ours is a filler for cheroots. You can never get a good covering leaf out of Ceylon. We all know what Sumatra tobacco is. For its production large forests, 200 and 300 acres in extent, are felled at a time and planted and after the harvest the land is abandoned and a fresh lot of jungle opened out and planted again, and so on. Another question I should wish to ask is: are we going to confine ourselves altogether to tobacco cultivation? We are going to spend R27,000 we have in the Agricultural Society. Is that

to be ear-marked solely for tobacco

cultivation? Are we going to be anything else but a Tobacco Committee or Sub-Committee because it is said here that "arrangements" be made for allowing the sum of R27,500 appropriated for the purpose of carrying out tobacco experiments to be drawn upon during the period October 1st, 1909, to Sept. 30th, 1912, or such longer period as may be determined? That is to say, of the balance we heard of the other day only about R6,000 are at the disposal of this Committee. I think that is a question that should be answered. We should be very clear about the matter before we could consent to such a large sum of money which at present lies in our treasury being laid aside for tobacco—and tobacco only. What if we find this Suporintendent, after he has been a year here at work, telling us that it is not much good trying to produce the required tobacco? We will have R27,000 of our money locked up for this tobacco experiment while there are other things requiring money—other agricultural matters of similar importance. (Hear, hear.)

Mr. R H Lock:—I might explain to Mr. Gibbon that the money has already been voted for this purpose—voted at the previous meeting of the Society that the money should be used in this way.

H.E. Sir Hugh Clifford:—I think Mr. Gibbon was out of the island at the time.

Mr. W D Gibbon:—I only know that out of our balance of R33,000 we are setting apart R27,000 for this work.

H.E. Sir Hugh Clifford:—R27,500.

Mr. W D Gibbon:—Therefore we have only R5,500 to play with.

"None but Experienced Men Need Apply."

value of rubber.

Dr. H M Fernando—remarked that para. 6 of the resolutions foreshadowed the employment of a gentleman with no experience of tobacco growing. They had in the island men with expert experience in the matter of tobacco cultivation and men with large experience in managing labour and getting work done in a short time, Such a one should be selected and sent out to study modern methods of tobacco cultivation and curing. To send the men selected to Sumatra, or the Philippines might not be quite successful as the tobacco growers there were men jealous of outsiders. He was very anxious that an early start should be made.

H. E. the PRESIDENT—understood Dr. Fernando to say that the man selected should have had practical experience in tobacco planting and managing labour.

DR. FERNANDO—answered in the affirmative.

TOBACCO IN JAFFNA AND THE EASTERN PROVINCE.

Mr DANIEL JOSEPH—heartily supported the resolution. The tobacco industry in the Northorn Province was a very important one and a large number of poor people depended on it for their livelihood. In the Eastern Province, too, tobacco was grown on a large scale, it was therefore important that they should do something to improve cultivation. He suggested that the Agricultural Board should vote a sum of money to send out two intelligent educated, and well-conducted young men to study tobacco growing and curing. After qualifying themselves they could be sent out to the different Provinces in the island to teach the people improved methods of cultivation and curing.

THE PEARL OF GREAT PRICE.

Mr A N GALBRAITH—referring to the statement that they could not get an expert from Sumatra—asked what steps had been taken to satisfy themselves to get an expert from there? He spoke with humility, not knowing the subject, but thought they could not got, anywhere in Ceylon, a man who had practical experience of scientific cultivation of tobacco. If there was one such, why did he not come forward before? Of course they might find such a person, that pearl of great price, who would show the intelligence and enthusiasm required of an expert. At the same time they could not tell their pearl from the outside of the shell. On the other hand they could be able to tell their pearl when they took it from a well-known bank. They should first of all know whether they could not get such an expert, even if they offered a higher salary than that contemplated, from outside the Island. The present salary offered, R3000 a year—he did not know how the estimate was arrived at—was very small; could they not offer R6,000 or so? He was presuming that the Sumatra tobacco estates were something like the Ceylon tea estates, and there must be some young creepers in Java or Sumatra to whom such a salary would be worth accepting. Supposing such a man came on a three years' appointment and was recognised as the Ceylon Government Tobacco Expert, there would be no difficulty for him to get a billet. Then they had to consider the suitability of Maha Illupallama for tobacco growing. He understood from the report of Mr. E E Green that the Society's tobacco cultivation experiments at Maha Illupalama had to be given up owing to the presence of the tobacco stem-borer. He did not know if the pest had been got over.

THE SYSTEM IN AFRICA.

Mr. BERNARD SENIOR :—It appears to me resolutions Nos. 3 and 4 are hardly financially sound. It is proposed to appoint a man and pay him a salary before he has got the special knowledge required. In the Colony I served in, Africa, we frequently had to get officers with special knowledge. Instead of securing experts as is the custom here, the system adopted there was to select some youngster and send him to a College in America or Canada, or wherever it might be, to qualify himself in the particular branch of work. In fact, I think we did exactly the same as regards tobacco cultivation and curing. Instead of paying him any salary we paid his passage, tuition fees, College fees, and boarding for one year. At the end of his period at College he produced a certificate of proficiency and then came back and was given an appointment for three years. Before he went out his parents or guardians, or whoever was responsible for him, signed an agreement that if he did not become proficient within that time they would refund the money expended. In that way Government stood to lose nothing except a year's time. At the same time they got the services practically speaking of an expert. If we do not safeguard ourselves we might appoint a man and be saddled with him for three years. At the end of his year's training in Sumatra he might come back without proficient knowledge and we will be saddled with a man who is useless for three years.

A STRANGE SUGGESTION.

Mr W A DE SILVA—pointed out that a person who qualified himself over tobacco cultivation in Sumatra would be of no use in Ceylon, conditions being different, enormous acreages being opened there, and that was not possible in Ceylon. He suggested that a person with experience of tobacco cultivation in the Island should be sent to a place where inferior tobacco was grown to bring his experience back to the Island. They could not produce superior tobacco and should, therefore, turn their attention to cultivation in small areas. It was not possible to get an expert on R3,000. He agreed with Mr Senior in the views he had expressed.

Dr. FERNANDO—enquired if any applications had been received.

Mr LOCK—said one or two had been received by the Secretary.

The Hon. Mr S C OBEYESEKERE—said the most practical and safest scheme was that foreshadowed by Mr Senior. Rather than jeopardise R27,500 they should first see whether on a small expenditure they could not train a man to suit their requirements.

THE EXPERT AND HIS TAMIL QUALIFICATION.

The Hon. Mr H L CRAWFORD—referring to the last resolution—thought it quite unnecessary for the man who was to be sent out to Sumatra to qualify himself in the Tamil language. Tamil was not spoken in Sumatra. There seemed to be a slight misunderstanding as to what type of tobacco should be grown. The opinion of the Committee was that competition with Sumatra tobacco was out of the question. (Mr Gibbon : Hear, hear.) Mr Senior had raised a very important point. Their duty would be to see how the efficiency of the Superintendent would be decided : how could they devise a test.

Mr BERNARD SENIOR:—There are training Colleges in America and Canada. That is where the youngsters from Africa are sent to.

Mr R H Lock:—Is there any Training College where the cultivation of tobacco is specially taught?

Mr Bernard Senior:—I think so.

Mr R H Lock:—I might add that I have at present attached to my Department four gentlemen employed in various African Governments. They have come here to study and they have agreed to refund their salary in the event of their not taking up the appointments.

Sir Hugh Clifford:—A portion of their salary.

Mr R H Lock:—Yes, in the event of not taking up their appointments. With regard to what Mr de Silva said I think the introduction of new species is certainly what we should aim at. I do not countenance for a moment the suggestion to go in for inferior tobacco. I think the only chance of developing the Ceylon tobacco trade is by obtaining markets for good tobacco outside Ceylon. On the question of the salary for an expert Dr. Treub of Java has written to our Society, saying that no expert grower would come from Sumatra for a salary of £400 or £500 a year.

The Hon. Mr. A. Kanagasabai—thought the meeting seemed to be agreed as regarded some of the resolutions proposed by Mr Lock. As regarded the first there seemed to be almost a consensus of opinion. As regarded the second, the same might be said of it. Then there was a divergence of opinion as regarded the third, fourth, sixth and seventh. So it would seem that they were agreed with the proposed experiment of growing new kinds of tobacco and of adopting new methods of curing tobacco as they found to be necessary, in the interests not only of Jaffna but all other parts of the island Tobacco was cultivated in the Northern and Eastern Provinces as well as in the North-Western and certain other parts of the island. The experiment proposed to be made would therefore be of practical value to the island generally. Such being the case, he hoped the difference of opinion as regarded certain of those resolutions would not delay the accomplishment of the idea. As regarded resolution No. 3 they would leave it together with the other items in the string of resolutions to the Society to decide in which way applications should be invited for the appointment of the expert or Superintendent of the tobacco experiments. The proposal made by Mr Senior was no doubt a commendable one, but he was afraid it would delay the accomplishment of the object in view.

Acting Governor's Remarks.

H.E. the Acting Governor—said he had listened to the discussion with very great interest and the impression on his mind was that they were not in a position to arrive at a decision on the subject that day. As. Mr. Kanagasabai said, there was a concensus of opinion on the first resolution. That was not surprising. Any demand of a contribution from Government was always unanimously supported. He would also be happy to give his support. If a satisfactory proposal was put before him, he was prepared on his own behalf to approve and recommend to Sir Henry McCallum that the full Rl0,500 required for the payment of the proposed salary of the expert be given; but he was not prepared to make such a proposal on the present system outlined. He would strongly urge on those present and the members of the Committee that all the sides of that question had not been adequately or finally considered. He agreed with Mr Gibbon's horror at the "expert" who exercised tyranny and from whom it was often impossible to escape. From his small knowledge of

SUMATRA AND BORNEO,

he knew it was not possible to obtain an expert. The system in the Dutch Colony was to pay small salaries for enormous toil to the young assistant who corresponds in Ceylon to the "creeper." From the Manager to the cooly every employee had a certain interest in the estate; and if the crop turned out good, so did the speculation; and a Manager, who got 3 or 4 successful crops, would be enabled to retire into private life. The salary given to a really expert Manager was very big. What they should consider was how best to secure a suitable man. He should not be sent to Sumatra or Borneo, but to places more nearly analogous to Ceylon. He doubted whether Mr Senior's scheme, good and sound in every way as it was, was a guide in the usual terms of such an appointment. The present circumstances seemed altogether different. Mr Lock had referred to the difficulty of testing the officer on his return. If they could not get an expert, who would be the expert who would test the expert? What they should do is to select some person they could rely on. At present there was no remedy if he idled his time. According to the resolutions the officer would have to spend the first year acquiring a knowledge of tobacco cultivation in India and simultaneously learning Tamil. It was essential that the officer should first learn all about Ceylon tobacco and then take up the study of Indian tobacco. Ceylon tobacco took in the characteristics of the soil and he was told that Sumatra tobacco taken across the Straits of Malacca and planted proved inferior to the variety from which it was taken. So in Ceylon, where there are varieties of soils and climates, they should experiment in various districts. He was doubtful if it would be possible to confine the experiments to Maha-Illupallama. There were many other points to be considered and he would suggest that the report be referred back to the Committee for further report.

Report Referred Back to Committee.

The Hon. Mr. H L Crawford—then formally moved that the report be referred back to the Tobacco Committee along with Mr. Senior's amendment for further consideration. The amendment was:—

"That an officer be selected to undergo a training for one year at some College or place to be decided by the Committee, the Committee paying his tuition fees, boarding fees and reasonable travelling expenses. These expenses shall be guaranteed by some responsible person on behalf of the officer and shall be refunded if the officer does not obtain a certificate of proficiency; on his obtaining a certificate of proficiency the officer shall be offered an appointment under the Board of Agriculture at a salary to be fixed by the Committee, and such appointment to be for there years."

Mr W A de Silva—seconded.—Carried.

THE PRICE OF JAMAICA TOBACCO.

June 9th.

DEAR SIR,—You are quite wrong in stating that Jamaica tobacco has been sold for 6s or 7s per lb. The facts are as follows:—

A quarter-of-an-acre of Sumatra tobacco was grown under shade cloth, and the best leaves were valued by a *local expert* at 4s to 6s per lb. But a sample of the crop was sent to England, and was there valued at 3s for first lengths, 2s 3d for second lengths and 1s 3d to 1s 6d for third lengths. They could only pick out *six good leaves* for this sample! Nothing is said about the bulk of the crop, and it is distinctly stated that there was none for sale. So Jamaica tobacco has not been *sold* at 6s, and it has not been valued at more than 3s by European valuers: that is, for the best of it, twenty-four leaves per acre. The cost of growing tobacco under shade cloth in Jamaica is 2s 2½d per lb., *provided the cost of the woodwork is spread over five years.* Evidently there is no fortune in that, and in the last report on tobacco in Jamaica it is stated that it does not pay large growers to cultivate tobacco at the present prices. It is hoped to establish a market for Jamaica leaf at 7d a lb.—Yours, &c., CIGAR.

[Our authority for the statement was Sir Henry Blake, who stated at Jaffna on August 19th, 1905:—"I heard from Jamaica only a month ago of the success of their experiments in that great Island and they tell me that there they have grown Sumatra tobacco which is valued from 6s to 7s a pound, or we may say from R5 to R6 a pound." Our ex-Governor must have been misinformed and we do not doubt the figures of our correspondent, who is well-informed on all matters of tropical agriculture. —Ed., *C.O.*]

DR. H. M. FERNANDO'S VIEWS.

In an interview to a representative of our contemporary, Dr. H M Fernando said, on the subject of tobacco cultivation in Ceylon:—

"We have got the assurance that if tobacco is grown here from Havana, Manila or Sumatra seed and properly cured and then sent to continental markets in sufficiently large quantities to attract the buyers, it will command satisfactory prices. Of course, it will not approach the well-known grades such as Havana, but there are a lot of mediocre grades coming from South America and other places. How did they create a market for them? Sir Henry Blake told us that ten years ago Jamaica was exactly in the same position as Ceylon is today. Small planters grew tobacco for local consumption, but it was absolutely useless for foreign markets. However, experiments were made and an expert appointed, who told them what seed to use and how to cure the leaf. They grew tobacco from Cuban seed and now they are exporting tobacco which is fetching prices equal to those obtained for Cuban tobacco. A German Syndicate from Sumatra came to Ceylon some years ago and worked in the Kurunegala District successfully for two years with both Sumatra and Havana leaf. They grew tobacco which was said to be equal to that grown in Sumatra. That syndicate gave up the enterprise in Ceylon, because they could not get the large tracts of land they required on terms equal to those upon which they could obtain it in Sumatra. As I have said, you cannot grow high-class tobacco on the same land year after year, so you require large areas of land, and for that reason I do not think tobacco will be a continuous cultivation, but will enable a start to be made with the opening up of the Wanni lands. You put down after tobacco, cotton, maize, oil crops, leguminous crops such as gram, etc., which are all paying things, with rice in irrigable areas. Of course, cotton must be alternated with other crops, because it takes too much out of the soil. There is a much smaller return from these products than from such things as toa and rubber, but it is a quick return. Coconuts take a very long time to give any return, and I think Ceylonese capital will be attracted toward products which give a much quicker return, even though it be much smaller, provided, as I say, that experiments conducted on sound lines demonstrate that there is money in these cultivations."

CASTILLOA ELASTICA FRUITING IN SINGAPORE.

A number of trees, raised from seed of *Castilloa elastica*, were planted in a low swampy bit of ground in the Botanic Gardens in 1898. The plant has not done well here at any time or in any place, and of those planted in this damp spot, some perished and others made little or no growth, after a few years. One however which had a certain amount of shade and had the advantage of having a rubbish pit within easy reach of its roots, has developed into a fine looking tree about 46 feet tall and has commenced to fruit plentifully. The seeds seem to be sound; I believe this is the first record of the tree fruiting here, at least I have no other record. Perhaps some of our readers know of other cases.—Straits *Agricultural Bulletin*, for July.

EFFECT OF A GALE ON A PARA RUBBER TREE.

A correspondent sends in a letter an account of a Para-rubber tree where the tap root seemed to have lost its bark which was growing again, and on which were large lumps of rubber. The tap root itself seemed sound and solid, though small in proportion to the size of the tree. The side roots were very numerous and healthy. Some of the side roots at a foot from the tree have broken up into a tuft of smaller roots, rather suddenly as if the end had died and the tree was trying to save itself by producing fresh roots from the cut or dead end. The tree itself looked as healthy as any in the block. No signs of disease of any kind were found. It appears that the ground on which this tree stands is liable to an annual gale and, while other trees in the block have been blown down or into a slanting position, this has resisted the violence of the gales. There is no doubt that the tree has had a violent wrench in one of these gales and some of the side roots parted and probably the tap root got cracked as well, so that the latex exuded to repair the damage. The tree however had so strong a hold in the ground by its anchor-roots that though some broke the others held firm and the tree did not fall.—Straits *Agricultural Bulletin*, July.

INDIAN AND CEYLON TEAS; AMERICAN ADVERTISING FUND.

[We have received, with the compliments of the Secretary, "Thirty Committee," the following report by Mr Blechynden :—]

REPORT SEASON 1908-1909.

I have the honour to submit my annual report for 1908-1909, the fourth season during which operations have been conducted by the Joint Fund, and the last, as joint work will now cease.

GENERAL PLAN.

2. My previous reports have been very full and have set forth in detail the system pursued. As the same lines have been followed the ground need not again be traversed here, and freed from the necessity of detailed explanations this report can be made brief. For the sake of uniformity subjects will be dealt with under the general heads previously used.

NEWSPAPER ADVERTISING.

3. Towards the middle of season 1907-1908, for reasons of economy, to offset expenses in other directions, considerable reduction was made in the area over which newspaper advertising had been conducted up to that time, and at the date of my last report we were using 65 newspapers in 33 towns in 4 States *viz* : Missouri, Indiana, Ohio and Illinois. Practically all these papers were regularly used for at least three years, and in a number of instances for four years.

4. During the season special work was extended, and as towns where newspapers are published were covered, the newspaper advertising was also extended, so that in March 1909 we were finally using 85 newspapers in 44 towns.

5. As we realised that the advertising in the new places could not be carried on for any great length of time, we tried to compensate for the absence of that continuous and persistent work which is recognised to be the most efficacious, by initiating and finally concluding our advertising, with extra large display. In starting in these new places we used quarter-page display advertisements for some days : these were then reduced to half the size, and in places where the conditions were suitable, grocers' names were in due time added to the regular advertisement. Later, when post cards were being sent to consumers, the newspaper advertisements were changed and included a cut corresponding with the figure shown on the post card. Finally, during the last two weeks of the season, a double-column five-inch advertisement was placed daily in all the papers we were using. Specimens of the various forms of the advertisements referred to are attached. This season newspaper paper advertising came to about 30 per cent of the total expenditure against 54¾ per cent last season and 66⅔ per cent in 1906-1907.

SPECIAL WORK.

6. The work done by our Special men has been fully described under this head in the reports for the last two seasons. During the season we visited 520 towns and villages, and tea was placed in 1,600 different stores. These bought 57,144 lb. of tea giving an average of about 35·7 lb. per store. Of this 23,099 lb. was black tea and 34,045 lb. green tea, giving an average of 14·4 lb. black and 21·2 lb. green.

7. Experience during the year has fully borne out the conclusions previously drawn, that the results obtained where our men accompany the Jobbers, Salesmen justify the expense. Unaccompanied Salesmen give incongruous results, appear to make spasmodic efforts and finally get discouraged, or confine their efforts to selling green teas, a relatively easy matter. These points might be clearly illustrated from our records, but I will not burden this report with details.

Stated briefly an analysis shows sales :—

With specialty men 16·6 lb. black tea, 20·2 lb. green tea, 36·7 lb. per store.

Without specialty men 7·2 lb. black tea, 24·2 lb. green tea, 33· lb. per store.

With specialty men mailing lists filled by 75·71 per cent. of stores.

Without specialty men mailing lists filled by 66·49 per cent. of stores.

8. As our aim is to have our black tea well distributed, so that there shall be a supply immediately available to meet any demand we can create, placing small quantities in a larger number of stores, answers our purpose better than placing large quantities in a few stores. To effect our object requires continuous steady work day by day, and calling at the small as well as the large stores. Our advertising scheme will sell tea to one class as readily as to the other, if it is properly presented.

SPECIAL TERRITORY.

9. During this season we have tried to round off and fill up the blanks in the territory with which we have been dealing. The four States mentioned have together about the same area as the two Bengals and Assam, containing over 200,000 square miles with an aggregate population of about 15 millions. These figures include the City of Chicago, with a population of about 2 millions, but we have made no organised attempt to deal with this great city. as to do this effectually we would have to devote our entire efforts and funds to this one purpose for a considerablo period. There are special difficulties in dealing with Chicago into which I need not enter. We are likely to get better results at a smaller cost in lesser places, in the aggregate more important to us than that one city. Meantime the packet teas continue active there; while they cannot, or do not, attempt the work we are doing, the result of our work will also benefit them in due time.

10. Maps are attached to show the places we visited during the season. If these are compared with the maps attached to previous reports it will be seen that there are but few places in these four States left uncovered, and these not important ones.

POST CARDS.

11. In my last report I mentioned that we had just received a new (the fourth) post card entitled "A Tea Picker," that 153,500 had been printed and some Nine thousand of these used in season 1907-1908. Later another odition of 26,000 of this card was printed, so that allowing for the number used last season we had 170,500

for the current season. This supply proved insufficient for our requirements, as by the end of March we had mailed 178,276 post cards and there were still mailing lists aggregating several thousand names to be dealt with. To make up the deficiency we have used cards printed for the India Separate Fund. They differ only in respect to the type matter, having been lithographed at the same time and from the same stones.

12. The number of mailing lists received during the last few weeks greatly exceeded estimates, as Jobbers made special efforts to obtain and send these, when they realised that it was their last opportunity. The monthly average number of cards sent out in the four months November, December, January and February was 6,298, while in the one month of March 11,639 cards were mailed. But for this final rush the estimate made 12 months ago, in the 20th paragraph of my last report, would have proved accurate.

Show Cards.

13. Show Cards for Grocers' stores to correspond with the post cards were received from the press in time for specimens to be sent with last season's report. Sixteen thousand three hundred of these were printed and have all been distributed.

Samples of Tea.

14. The advertising system we have followed, fully described before, includes sending through the mails direct to consumers, a sample of tea and a measuring spoon enclosed in a box carrying printed instructions for making tea. The address tag bears the name of the Grocer who supplied the address and thus conforms to the system followed with the post card.

15. During the season 83,119 samples were mailed and several thousands have yet to be sent in accordance with our obligations to Jobbers who are in turn committed to the Grocers to whom they have sold tea. At present our liabilities in this way are estimated to be between 15 and 16 thousand samples, so that by the time we close the account we will, on account of this one season, have sent out some 100,000 samples as follows:—

April, 1908	17,507	July, 1908	7,936
May, 1908	6,453	August, 1908	5,546
June, 1908	10,166	September, 1908	3,141
October, 1908	4,414	January, 1909	4,99[illegible]
November, 1908	3,253	February, 1909	6,112
December, 1908	4,430	March, 1909	9,165
		Total	83 119
		Estimated commitment	16,000
		Probable total	99,119

16. It is convenient here to summarise the figures for post cards and samples together and show the number of pieces of advertising matter sent through the mails direct from this office:—

Post cards sent to 30th March ..	178,276	
Estimated requirement to close..	12,659	
		190,935
Samples sent to end of March ..	83,119	
Estimated requirement to close..	16,000	
		99,119
		290,054

Against 257,000 pieces sent out last season.

Tea Measure.

17. We have continued to use these with the samples sent out. There may be a few gross left in hand when the last lot of samples yet to go, have gone. These will be handed over to our friends the Jobbers who will be exceedingly glad to get them, and they will be fully utilised for the purpose for which they were designed.

Food Shows.

18. There have been no Food Shows held in this territory during the season as the Grocers suffered greatly from the depression in business and did not care to incur the expense. We have, however, assisted a Jobber who "demonstrated" tea in a department store, sharing the expense with him. As all sales of tea were registered to the credit of the Grocer patronised by the purchaser, and the retailers' profits sent to the various Grocers concerned, no antagonism was aroused.

19. For a part of the year we continued our co-operation with the Jobber mentioned in paragraph 30 of my last report, who had a special man calling upon Grocers and showing them and their clerks how tea should be made and inducing as many of them as he could persuade, to try a cup. This work is excellent where it can be watched and followed up by the Jobber, but is something we cannot usefully attempt ourselves. It was discontinued only because the Jobber in question desired to utilise the services of his special man in a more directly remunerative way, and was unable to find a suitable man to carry on this special work.

Indian and Ceylon Post Cards.

20. This is our novelty this season. It is also so far as we know and as we believe it to be, an entirely novel and original form of advertising the products of one country in another country. The idea behind it is that post cards bearing foreign stamps and postmarks, carrying views of attractive subjects, will attract immediate attention, and the advertising matter these bear will have greater consideration than if it came before those we aim to reach, in a more ordinary way. The appeal made to the Grocer by the importance given to him when his name is printed on a post card mailed in a foreign country is a factor to be considered. The fact that he is selling genuine India and Ceylon tea is also in a measure vouched for to his customers. To realise the advertising value of the scheme one has only to consider how a similar scheme worked for, say, Havana or Porto Rico Cigars would influence a person residing in a small town in England, where he and some of his friends to receive different post cards from Cuba mentioning the name of a local tobacconist.

21. The detailed working of the plan has thrown a great deal of work upon the executive of the Indian Tea Cess Committee in Calcutta. The use of post cards in such a manner was not quite clearly covered by the rules of the Postal Union, so, before we ventured upon printing the large number required the points raised were placed before the proper authorities in India and then test lots were sent through the post. Some of these were surcharged owing to the rules not being very clear, but finally the difficulties were cleared away. Meantime through the kind offices of Sir James Buckingham negotiations had been opened with Messrs. Raphael Tuck &

Sons and during the summer, when in England, I arranged for 150 thousand post cards with printing outfits to be sent to Calcutta.

22. Since then we have had to order about 60 thousand more of these cards as the mailing lists sent to Calcutta together with those yet to go are estimated to contain over 200 thousand names. The organising of a proper staff to deal with this large number of names and generally to handle the scheme properly has been thrown entirely upon the Calcutta executive, and I desire to point out that but for their kindly consenting to assist in this matter it would have been difficult to have carried out the scheme.

23. The post cards have been arriving with considerable regularity, but it is not possible to obtain precise reports as to their effect. In their nature they are appeals to individuals widely scattered over a large territory with no common channel of communication with us ; and like all other general advertising not keyed by direct sales, the value has to be assumed. We know that the cards aid in selling tea to Grocers.

24. Before concluding the subject I may mention that 18 cards were selected, ten of these being India and eight Ceylon views, Although each consumer will receive but one card, it may be assumed that many of the recipients will compare cards and a variety has been used with this in view, to enhance the interest the cards are intended to create.

Wagon Umbrellas.

25. The last section dealt with a novel form of advertising and I have here to record our use of a well-known and favoured one. Wagon Umbrellas are substantial affairs 5 feet in diameter mounted upon strong 6 foot poles and provided with metal attachments to fix them upright to the driver's seat or allow of their being closed and laid flat if desired. The stout cloth tops, of six panels alternate red and white are lettered in bold characters with the words India and Ceylon Tea in each panel. The unusually cool weather has delayed their distribution but 2,000 will be in use during this summer. In effect a wagon umbrella is a portable and travelling bill board, carried into all parts of the City in accordance to the wagons errands. As a large number of these have gone into country places we can count upon their being carried all over the State. We could distribute a great number more with advantage but summer is the season when they are in demand and the work has now ceased.

General.

26. Last year's report included a statement showing the imports of tea into the United States for each of the years since 1898, the amount of India and Ceylon tea imported in each of these years and the percentage of these to the entire imports. The figures were compiled from the United States Customs returns made up to the 30th June and those to 30th June 1907 were the latest then available. I now therefore add the figures to 30th June 1908 and may point out how they compare with those for the previous year :—

Imports to 30th June, 1908.	All teas.	India and Ceylon.
1908 ..	94,149,564	19,241,271=20·4 per cent
1907 ..	86,368,490	16,657,791 ,, 19·2 ,,
Increase ..	7,781,074=9%	2,583,480 ,, 15·5 ,,

Gross Imports of Tea into United States for Years Ending 30th June.

	All Teas.	India & Ceylon.	Per Cent.
1898	17,957,912	6,984,375	9·7
1899	74,039,899	4,930,317	6·6
1900	84,845,107	8,246,230	9·7
1901	89,806,453	7,187,594	8·3
1902	75,579,125	8,475,179	11·2
1903	102,574,905	15,007,367	13·8
1904	112,905,541	16,485,554	14.6
1905	102,706,599	17,013,678	16·3
1906	93,621,750	17,696,994	18·9
1907	86,368,490	16,657,791	19·2
1908	94,149,564	19,241,271	20·4

27. The current season will end on the 30th of June and it will, I think, mark the beginning of a new condition for India and Ceylon teas in this market. The possibility that an import duty would be imposed upon tea began to have a perceptible effect on the market in November, when several well known tea men gave evidence before the Ways and Means Committee of the House of Representatives at Washington. By about the end of January the available Japan and China tea having changed hands, sometimes more than once, attention was turned to India and Ceylon teas. These are always the last to share in market activity owing to the proximity of the stock carried in London. As it is anticipated that the tariff bill will be passed before the 1st June, and new teas will not be available from China and Japan to arrive within that date, Importers have brought in unusually heavy shipments, not only from London and Canada but even from Bremen and Hamburg to anticipate a tea duty being imposed. While all the teas thus imported may not be India and Ceylon, by far the larger part comes from those countries. Much of this tea was bought when the London market was affected by the fear of an increase of the British tea duty, so that the purchases made were probably not so exclusively cheap that they can be shipped back profitably. Therefore we may anticipate that whether a duty is imposed, or otherwise, these teas will be forced into consumption and will help to create a market for further supplies.

28. I realise that the matter dealt with in the last paragraph does not fall strictly within the limits of a report dealing with the work done by ourselves, but I desire to point out that but for the work carried on by the India and Ceylon Funds in past years, the market here would not have been prepared to deal largely with teas that had not been properly introduced to the public, and for which no outlet had been created. India and Ceylon are now getting the benefit of the opening created by past work.

29. I have on a previous occasion pointed out that the expansion of this market will, within a very few years, require larger supplies of India and Ceylon tea than appear likely to be available unless larger areas are planted out. Already there has been a great increase in the importations of China Black teas, and should the demand for India and Ceylon teas in this country increase in the future at the rate it has done in recent years (it was 8,000,000 lb. in 1902 and 19,000,000 lb in 1908) prices will rise, and a great impetus will be given to China black tea importations, here and in Canada.—K Blechynden, St. Louis, 10th May, 1909.

RUBBER IN NYASALAND.

(*From the Government Handbook—1st issue —1909.*)

Rubbber for export is chiefly obtained from the indigenous Landolphia vines which are fouud on the banks of streams throughout the country. It is usually collected by natives; brought to the stores and traders for sale; occasionally Europeans engage in collecting it in districts where it is plentiful, employing natives to carry out the work of tapping the vines and drying the latex that exudes immediately the incisions are made in the bark.

The export of rubber for the past eleven years is as follows :—

			lb.			£.
Year ended	31st	March 1898	21,416	Valued at	1/-	1,069
do	do	1899	91,264	do	2/3	10,267
do	do	1900	118,720	do	2/3	13,356
do	do	1901	85,904	do	2/3	9,669
do	do	1902	14,393	do	2/3	1,619
do	do	1903	11,723	do	2/-	1,172
do	do	1904	4,372	do	2/-	437
do	do	1905	17,664	do	2/6	2,208
do	do	1906	17,280	do	2/6	2,160
do	do	1907	16,403	do	4/3	3,486
do	do	1908	15,533	do	4/3	3,300

There is a duty of 4d per pound on the uncultivated product, but none on rubber obtained from cultivated trees.

It is estimated that about 1,500 acres are now under rubber cultivation by Europeans, and the following information on the industry has been supplied by the rubber experts employed by the African Lakes Corporation on the Chombe estates in the West Nyasa district, and on the Chitakali estate in the Mlanje district.

Indigenous Rubber (*Landolphia*).

The cultivation of the vine from seeds in nursery was commenced in January, 1903, when 10,000 young vines were raised; and transplanted to the forest in 1904. Again in 1904, 100,000 vines were raised; in 1905, 50,000; and in 1906, 600,000. The plants were at first kept in nursery for from ten to twelve months and then transplanted to the forest, but the transplanting proved to be a great check, and the rate of growth afterwards was not satisfactory. At the same time direct sowing throughout the forest on prepared mounds was tried, but also proved unsuccessful, as those seeds which did not rot were torn up by wild pigs. The best results have been obtained by sowing the seeds in bamboo pots, four or five in each pot, keeping them under shade in nursery for a year, and then transplanting to forest. The cultivation of the vine involves very considerable initial expense, and then waiting ten to fifteen years for a return.

Para Rubber (*Hevea Brasiliensis*).

Early in 1906 a Wardian case was received from Ceylon containing 2,000 Para seedlings. Of this consignment 266 plants survived and are doing very well, some of the trees being as much as 12 feet in height in July, 1908. In January, 1907, the same trees were only five feet high, and the further growth is regarded as very satisfactory. None of the plants up to the present have shown any signs of disease. In January 1907, a further consignment of six Wardian cases was received. When despatched from Ceylon these cases contained 6,000 seeds, but only some 2,500 survived the journey, and were planted out at 20′ x 20′. Of these about 1,600 are alive and doing well, the large percentage of deaths being due principally to white ants and the grub of the cockchafer. To get rid of the latter pest a mixture consisting of one pound of Paris-green and three pounds of salt to 40 pounds of donkey manure was used and proved effectual, when dibbled in some little distance from the roots at time of planting. With Para the best results have been obtained on good *dambo* land, well drained; the danger of the plants being killed by the two pests mentioned is very much less on such ground than on the drier and lighter red soil. If the present rate of growth be maintained, tapping operations ought to commence by 1911, and the trees may be expected to flower in 1910. In order to ascertain whether Para trees can be raised from seeds packed in charcoal, a large consignment of these was brought out from Ceylon in 1907, but none of the seeds germinated. A further trial was made in 1908, and with better results, as out of 100,000 seeds 14,850 have germinated and show promise of doing well.

Castilloa Elastica.

Seeds of this variety were first received from Ceylon early in 1906, and were sown in a prepared nursery. A very large percentage of the seeds were rotten on arrival, but over 400 plants were raised from the lot, and they were planted out at the commencement of the rains. There are now 448 plants alive and doing well. The rate of growth has not been so rapid as that of Ceara and Para, but the plants are all very strong and healthy, the highest trees being now nine feet high. Castilloa does not like a wet soil and should not be planted where there is any chance of water lying during the rains. As in the case of Ceara, it would appear that Castilloa does best in a good red soil. Experiments go to show that better results would be obtained by sowing at stake, 2 to each, and transplanting later, provided the seeds were in good condition. As regards distance between the plants, probably 20′ × 20′ apart is wide enough in this country.

Ceara (*Manihot Glaziovii*).

The cultivation of Ceara was commenced in 1907, and so far as growth is concerned is very satisfactory, plants raised from seed sown at stake in January, on good deep red soil, being 6 to 8 feet high in August, 1907, and as much as 16 feet high in July, 1908, *i.e.* 16 months from date of sowing. The land for Ceara should be prepared and made ready for planting at the commencement of the rains. The seeds should be filled at the radicular end, and not sown too deep. Sowing at stake is by far the best method, and if the seeds are sown early, 2 to each hole, the plants will, by the dry season, be able to fend for themselves and require neither watering nor shade. If the seeds are sown late the plants remained small and stunted. Ceara seems to thrive on any soil except a wet one; 12′ × 12′ is about the right distance apart. There are some 7,000 Ceara trees growing, which were sown in January, 1907, as well as many thousands of later date.

FUNTUMIA ELASTICA.

A small quantity of seeds was received in November, 1907, from Uganda, and they germinated well. The seedlings look well at present and have attained a height of 2 feet 9 inches in eight months. Funtumia latifolia is found in the forest. The seeds that fall on the ground germinate freely and the young plants spring up quickly. It is only found in lowlying sandy parts of the forest. Unfortunately the latex of Funtumia latifolia is of no real commercial value but if this variety does well in the West Nyasa district so also should Funtumia elastica. Some of the seeds of the latter obtained from Uganda were packed in tinfoil, and others in slightly damped charcoal powder. The last named gave the better results.

JEQUIE MANICOBA AND REMANOO MANICOBA.

Seeds of these two varieties have just been imported, but it is not yet known whether they will be successful.

TAPPING AND AVERAGE YIELD OF LANDOLPHIA.

Vines may be tapped every year for a long time if tapping be carried out in a proper manner, but there is much danger of injuring the inner tissues, and the greatest care is required. Vines yield on the average about 1 ounce of rubber per annum, dependent principally on the age of the vine. As much as 7 ounces have been obtained in one year from specially fine vines.

MANURE.

Both Para and Castilloa benefit greatly from a good manuring with cow manure and wood ashes during the rains. When manuring, 12 inches of a spread for each year of growth is allowed the roots.

THE PREPARATION OF COPRA.

Under present conditions, when the copra reaches the European market, it has already undergone at the place of production a preparation which consists in cutting the fruit and letting the albumen dry by exposure to the air, the sun, or artificial heat, after which the albumen is separated from the shell and shipped.

This preparation presents the serious drawback of allowing micro-organisms to develop on the surface of the albumen, penetrating the mass and bringing about a partial deterioration of the fatty matter. At present a large quantity of the copra landed is covered with mould, and gives out a strong rancid odour. There is thus a considerable waste, and all oil extracted has to be purified.

M. Dybowski, the Director of the Paris Colonial Gardens, is of the opinion that this difficulty can be overcome. He proposes a treatment by which the surface of the copra is sterilised before shipment in such a manner as to withstand the action of the micro-organisms. He has been conducting experiments since 1905 with sulphurous acid and some samples preserved since that date still show no sign of deterioration, while the product not so treated deteriorates in a few weeks. M. Dybowski made a further trial in June last on a consignment of 3,000 coconnts imported from the Malay Archipelago. The nuts, after being cut in two, were exposed to the action of the sulphurous gases, by means of the Marot apparatus. This operation was repeated on successive lots, and it has now been established beyond doubt that under the sterilising influence of this gas the original condition of the copra is maintained. This is an important discovery that should give a considerable impetus to the copra trade. —*L & C Express*, July 9.

SUGGESTED CACAO SPRAYING EXPERIMENTS AT TRINIDAD.

In order to obtain accurate results upon which to base recommendations for the use of fungicides in cacao cultivation, the Mycologist to the Trinidad Board of Agriculture (Mr J Birch Rorer) has drawn up a scheme of cacao spraying experiments, which was recently submitted to the Board for approval. This scheme includes experiments in which insecticides are also to be used, both alone, and in combination with the fungicides. For the work which it is proposed to undertake, a block of 800 cacao trees in good bearing, located in a district where diseases are prevalent, will be required. The trees should be in good condition so far as pruning and culture are concerned, and should be in fertile soil, so that they will be able to mature a good crop of pods. For purposes of exporiment, the 800 cacao trees will be divided into forty plots, each containing twenty trees. Thirty-six plots will be sprayed, and the remaining four will be left unsprayed as control plots. The thirty-six plots to be sprayed are divided into six classes (each class containing six plots), and each class is to be treated with a different spraying mixture. Thus the first six plots are to be treated with Bordeaux mixture, the second lot with Bordeaux mixture and arsenate of lead, the third with self-boiled lime and sulphur, the fourth with commercial lime and sulphur, the fifth with arsenate of lead and lime, and the sixth class with contact insecticides. In addition to the question of the relative value of the different spraying mixtures, the experiment is also designed to investigate, in the case of all the mixtures, the influence of the frequency with which spraying is carried out. The six plots in every class are to be treated with the same mixture, but the frequency with which the six plots are sprayed will vary from two to eight weeks. The amount of cacao gathered from each plot throughout the year will be recorded, and an accurate account of the cost of spraying will be kept. The beneficial or injurious effect of the mixtures upon pods, trees and flowers will be noted. No results of the experimental work are to be published for at least one year. In these experiments the Board of Agriculture will furnish all spraying apparatus, mixing plant, and materials for the work, but the labour required for the spraying operations would be supplied by the owner of the estate on which the work was done. —*West Indian Agricultural News*, June 12.

OUR COCONUT PRODUCTS.

PROGRESS DURING THE HALF-YEAR.

The exports for the half-year, with the exception of desiccated nut and copra, show a shortage as compared with the same period of 1908, but, taking them all over, the demand seems to have been very steady. The greatest increase to end June we find in copra, which shows some 107,552 cwt. exported in excess of last year, the figures for the six months being no less than 272,893 cwt., resulting to date (30th June) in low but steady prices. Unfortunately, owing to inferiority in quality of our nuts—the like of which must, we think, be unknown to the oldest inhabitant, and which is doubtless the result of an abnormally short rainfall in 1908—less severe, perhaps, in the Galle and Matara district—over our coconut belt which extends practically from Puttalam in the North-West to Hambantota in the South-East, it has been taking from 30 per cent to 50 per cent more nuts to produce a candy (5 cwt.) of copra; so that, with thin kernel on the one hand and low selling prices on the other, it has been, we conclude, anything but a good paying year so far for the copra drier.

The strange part of it is, however, that with practically 18 months continuous drought to end of June North of Colombo, there has been little or no shortage of nuts—*such as they are*—over the half of current year. The very reverse of this was predicted by those experienced in nut cultivation. In fact, we know of one mill when the nut supply was actually in excess and more work was done than in any previous year; so that it would appear that while a very short rainfall causes a considerable falling-off in the quality of the kernel, there is but little if any decrease in number of nuts this remarkable tree produces, even in our *very driest zone*. Here considerable extensions may be looked for with the advent of the Puttalam railway, really *the only line ever clamoured for by the sons of the soil*, and which is bound to come after our Governor has made himself heard in Downing Street. Now, with regard to the excess of some 5,370 tons of copra shipped already this year—and which probably will be doubled by December, we think it is not hard to account for this. It must be remembered that while nearly all the European and American oil was formerly used for soap-making, a new and very important industry has sprung up on the Continent and in U.S. America, in edible fat—to which we have before now alluded. The consumption of this, owing to its cheapness as compared with other fats, is in great and ever increasing demand; and the manufacture of it is, we think, bound to increase rapidly and probably in a far greater ratio than nut planting anywhere. Besides, we must not forget that "as the tree lives, so must it die." The most remarkable feature in this new nut produce is that it is to date made, we may say, entirely from the ordinary sun-dried copra; so that, there must be room for improvement. Indeed, we do not see why this same fat should not be made locally with an abundance of cheap village labour and become a very important Island industry. Of course, it might reduce our other nut products; but to do that would doubtless increase the demand for them and so raise their prices commensurate with the cost of the raw nuts when the great menace of today, the demon Over-production, would vanish.

The falling off in the export of coconut oil (some 24,752 cwt.) can easily be accounted for when we turn to the excessive export of Copra and desiccated nut. And we must not orget that the drying of this product depends, on the price of oil, and this while being very low over the period now under review was very steady, ranging between R378·75 and R430 per ton; but, from what we can gather, everything points to a run of very high prices for oil, and which is sure to reflect on copra and nuts. All the same we do not suppose nuts will ever go to the price they did in 1907, our record year, when our present and future great opponent, Java, sent away in the 1st quarter only 13,464 tons against nearly double that in 1908—little Lanka figuring in 1907 at only *3,832* tons, against some 14,750 tons over the same period of 1908. This proved conclusively that 1907 was the very worst on record for our palm produce, when nuts went in some cases to R75 per 1,000, and copra exceeded R87.

The figures for desiccated coconut an ever-increasing product, show a very small increase over same time last year with its huge 4,000,000 lb. over 1907, all of which, while causing a considerable glut at home, went off. Inthis mills also were hard hit, with very low prices on the one hand and the poorest outturn on record on the other; it took nearly 3½ nuts at times to the pound, against the usual three nuts and at times under that and which they generally get over the first half of the year. Nuts came in very freely, in fact, more so than usual, owing no doubt to copra men going slow; for it was equally hard for them to make ends meet with such poor nuts, taking at times fully *1,500* to make a candy of copra.

The advanced price of nuts in sympathy with the rise in oil and copra has caused a rise in desiccated of 2 cts. to 2½ cts. per lb. and, if there is a further rise in oil, it will go higher, there being a regular run on copra-drying, very high prices being paid by these men who know exactly when to procure the very best nuts.

Poonac shows a decided falling off and points to crushers at home and elsewhere getting their poonac cheaper and fresher than they can import it.

There is a slight falling off in coir, but many mills being still closed down should relieve the over-production of the last year or two.

MANURING TEA AND RUBBER.

With reference to the paragraph recording a visit of Messrs. Joseph Fraser and G. A. Talbot to Rothamstead, in which it was stated that 'slag' is regarded as a medicinal dressing for certain soils, just as arsenic is used as a medicine for certain complaints, an experienced authority in England, who reads the Overland *Observer*, writes:—"I am

sure of this, that the average Ceylon tea soil which is deficient both in organic vegetable matter and phosphate of lime is not the kind of soil upon which basic slag gives the best results. I should like to see experiments made with Basic superphosphatic—equal money value—against Basic slag and a careful report made on same. There is not, in my opinion, much at Rothamstead that could apply to Ceylon."

APPARATUS TO EXTRACT CAMPHOR.

A Burmese Invention.

Bassein, June 26.—It is not generally known that after many years of quiet experimenting, Maung Thein Maung, at present Township Judge of Ngathainggyaung in this district has at last invented an apparatus for extracting "ngai camphor" from *Blumea balsamifera*, which grows luxuriantly everywhere in Burma and is locally known as "ponmathein." The inventor claims that by a process of condensing in this apparatus, camphor or a substance with all the qualities of camphor, can be produced at a minimum of cost and labour; and he has now filed a specification with the Government of India of his invention under the Patents Act, wherein he describes the invention as follows:—The lower vessel or boiler, which is made of tin or galvanised sheet iron, has a neck and a false perforated bottom. There are two pipes which run to an inch of the bottom of the boiler. The tops of these pipes are funnel-shaped. The top vessel, which is called the condenser, is slipped into the neck of the boiler. The condenser has an inner vessel called the collector, with pipes. The outer shell of the condenser holds water which runs down the pipe, and the heated water is drained away by another pipe. Taps are attached to the condenser and the boiler respectively, for drawing away their contents. The method of extracting the camphor is as follows:—The boiler is filled with water in which is placed the plant *Blumea balsamifera*. The condenser is then filled with cold water, and heat is applied to the boiler. When the water begins to boil, the steam draws the camphor in the plant and carries it up to the collector. The condensed steam which more or less contains dissolved camphor, runs down by the pipe back into the boiler; consequently the camphor is carried up again by the steam to the collector. The distillation is thus carried on until the plant is found to contain no more camphor. The novelty of the invention lies in the fact that, unlike an ordinary still, the extraction of the camphor is perpetual and automatic. The specification is illustrated with diagrams explaining the process of condensing. Maung Thein Maung is confident of the success of his apparatus, and has already manufactured a considerable amount of camphor by it, samples of which he has sent to China, the Straits and elsewhere for opinion as to its quality and in order to ascertain whether this camphor will have a good market there. It is his intention to ask Government to permit him to manufacture camphor without prejudice to his appointment as a public servant.—*Rangoon Gazette*, July 5.

LIMA BEANS.

Just now the following extract from an American bulletin on beans may be of interest:—

Under the name of Lima beans two distinct types are now recognised: Pole Limas and dwarf, or bush, Limas. These types are made up from two distinct species, known to botanists as *Phaseolus lunatus*, which includes the Sieva, or Carolina, type of Lima beans, and *Phaseolus lunatus*, variety *macrocarpus*, the true Limas of the Amerigan garden, which includes both types of this bean, i.e., the flat, or large-seeded, Lima and the Potato Lima. The pole Lima beans, then, are made up from the Sieva, or Carolina, Limas, the true Limas, the flat, large-seeded Limas, and the Potato Limas. The dwarf Limas are represented in the Sieva type by Henderson's Dwarf Lima, in the Potato Limas by Kumerle's and Deer's Dwarf Lima, and in the true Limas by Burpee's Dwarf Lima. It will be seen, therefore, that botanically the pole Lima and the Dwarf Lima cannot be separated—that varietal differences alone make the distinctions which characterise these two groups.

Lima beans are of very great commercial value, but are not sufficiently appreciated as a table food because it is not generally known that in a dry state they can be used in practically the same manner as are the common beans. In reality they are richer and more delicate in flavour than the common beans, and can be used in as many different ways. The virtues of these types as green beans need only a passing mention, and their value as an accompaniment of corn in succotash is well known to every consumer of canned goods.

THE DANGER OF OLD STUMPS.

(*By F. A. S.,—in the Journal of Board of Agriculture, British Guiana.*)

Considerable areas of forest land in the colony are being taken up and cleared for the cultivation of such crops as rubber, cacao and limes. It is thought desirable to warn cultivators that the logs and the stumps of trees that have been felled may constitute a danger to the cultivation, and that certain precautions should be taken. It has repeatedly been noticed that plants planted in very close proximity to a fallen log or old stump may sooner or later die. This has been held to be due to "poisonous juices" from the rotting of the log or stump, and on account of this a large number of planters will rarely put in a young plant near to either a log or a stump. As the stumps or logs commence to rot, it has been observed that fungi are invariably present, and instead of the "poisonous juices" causing the death of the seedlings, it is the fungi spreading from these rotting logs to the roots of the plants that destroy them. On several occasions fungal threads have been traced directly from a rotting stump to the roots of young lime plants, and it is concluded that the fungus on account of increased growth in so

suitable a medium as a rotting log may have become sufficiently vigorous to kill out those growing plants in the immediate neighbourhood. A large number of plants in the West India Islands have been lost in this manner, and in the report of the Government Mycologist for the Federated Malay States for 1907 it is stated that the greater number of inquiries from planters in respect to diseases of rubber referrod to the root disease caused by a fungus that had spread from some of the numerous old jungle stumps among the rubber trees to the healthy young plants of from fifteen and thirty months old. It is further reported that fungal threads have, on different occasions, been traced from an old stump in the nursery to young plants immediately around it. The removal of stumps from large areas of newly opened land is of course impracticable, and, therefore, planters must be prepared for some cases of these root diseases. In planting out, however, it is preferable that young plants should be set out of the "line" rather than they be planted too close to either stumps or logs. Further, any plants that subsequently show signs of root disease should at once be isolated by digging trenches around them at least 18 inches deep, and those that die should always be removed and burned or otherwise they will become sources of infection. On no account, however, should stumps be allowed to remain in any land that is to be used for the purpose of a nursery. They should always be carefully removed, for when planting is being done the young plants that might become affected would, in most probability, be distributed throughout the whole plantation. Those diseased plants would not alone die out, but would form centres of infection and therefore be a danger to the entire cultivation. In cacao cultivation in the West India Islands it has been noticed that root disease frequently commences from bread-fruit, bread-nut, or avocado pear trees that have been planted in the cacao, and it is, therefore, advised that in new plantations these trees should not be planted, and that when any such trees have to be removed from old plantations care should be taken to extract their roots.—*Proceedings of the Trinidad Agricultural Society* for May.

RUBBER IN MALAYA.

DUTCH EXPERT OPINIONS.

Yesterday there passed through Singapore Dr. A H Berkhout, late Conservator of Forests in Java, who was in the rubber planting field in the island a quarter of a century ago, and left for Soerabaya this morning.

Dr. Berkhout has spent three weeks on the rubber estates of the Peninsula, and as he has also had experience in Surinam, Brazil, as well as Java, his observations should be of value. In answer to questions by a representative of the Singapore "Free Press," he said he had visited estates in Province Wellesley, Perak, Selangor and Malacca, and had made careful observation of the uature of the soil, and the effect of close or wide planting. He has to study out the full effect of the observations yet, but is well able to form an opinion already.

Malaya for Hevea.

Hevea, thinks the Doctor, grows on the alluvial of the Peninsula better than in any other part of the world he has visited. The exporters in Brazil have no chance to compete with the planters of Malaya. They can put their clean plantation rubber on the market at at anything between one and two shillings a pound. The least that can be done with Para is over 3s a pound.

"With better methods of tapping?"

"The tapping in Brazil is irregular and unscientific, and three or four tappings spoil the tree. Then the quest has to be carried further afield, and the wild rubber becomes still more expensive."

The Rainfall; and Planting.

Dr Berkhout thinks that it is not the quantity of rain that falls that makes any difference, but the regular distribution over the whole year. That is the climatic strength of Malya. The estates, generally speaking, are well managed, but there is much yet to be learned by careful observation and experiment on the best way of cultivating and tapping. Planters will have to exercise their sound sense, and profit by their experience in this respect. The manner in which the young plants are transferred from the nursery and planted strikes him as being far too rough. It would be better to plant the seeds in baskets and carry them in the baskets to the site of planting.

Close Planting.

Dr Berkhout favours close planting, with subsequent thinning out judiciously. He says it is quite a mistake to suppose that every acre of the estate shall bear a certain number of trees. He would plant 12 feet by 12, and no harm will result, but before the age of 20 the number of trees will be very largely reduced. No dead trees are to be replaced, except when a patch is for some reason cleared. The thinning out must be continuous, and regardless of symmetry. Pruning to get a great number of trees on the land, he considers harmful, the wounds being particularly susceptible to parasites. The thinning out must be continuous, he repeated. It does not, however, mean cut down every other tree, nor half of the trees.

Weeding.

Clean weeding is a costly process at the commencement, but it ensures quick growth of the young trees. Dr Berkhout does not think much of the experiments in planting mimosa, crotalaria, desmodium or passiflora. It is true the first three plants add to the soil nitrogenous constituents derived from the air; but are not the soils of the rich lowlands nitrogenous enough, and do not the leguminosæ do harm in preventing aëration of the surface layers of the soil? At the present price of rubber Dr Berkhout is clearly in favour of clean weeding; the returns will stand it.

Dr Berkhout desired to acknowledge the courtesy shown him by officials and planters. He hopes to visit Ceylon on his way home from Java, for which island he sailed this morning.—*S F Press*, July 17.

TERMES GESTROI AND RUBBER.

INTERESTING NOTES BY THE F.M.S. DEPARTMENT OF AGRICULTURE.

Mr H C Pratt, Government Entomologist, F.M.S., has just issued a bulletin containing "Observations on Termes gestroi, as affecting the Para Rubber tree, and methods to be employed against its ravages." It will, of course, be necessary for estate managers to read the pamphlet themselves; no mere summary could give an accurate view of its valuable contents. We merely indicate them. Mr Pratt points out that the factors which decide the prevalence of Termes gestroi on a rubber plantation are misunderstood. "There is," he says, "a popular impression that gestroi has reached its deserved designation as a pest merely because rubber (Hevea Brasiliensis) has been planted in the F.M.S. I wish to show here that it is not the product which is planted that is the main cause of the encouragement of gestroi, but the interference with nature when large acreages are felled; it is therefore the object of the planter to meet as far as lies within his power these changed conditions. Take into consideration the method of planting in the F.M.S. 1,000 acres of land are taken up for the purpose of planting rubber. The virgin forest is felled, burnt and the acreage planted. The burn may have been good, then so much the better; on the other hand it may have been bad, and very little of the timber is destroyed. Whether the burn was good or bad a great deal of the harder wood is left undestroyed. In either case the land is planted, and no heed whatever is taken of the mass of felled forest trees which form a continued network of logs lying upon the surface of the soil.

"The sole object of the planter is to bring his trees to a tappable stage as quickly as possible, and at the lowest possible cost, regardless of the consequences which may follow such a procedure. He forgets, or does not attach sufficient importance to the fact, that at least two per cent of the larger and sometimes of the smaller logs and stumps, very few of which are ever completely burnt away, either have gestroi in them, or will harbour them in time. A freshly felled piece of land is thus a perfect home for this insect; every facility is present for its multiplication; its dissemination from stump to stump, and log to log, is rendered so easy, and there is a food supply sufficient for several years. After having encouraged gestroi to such an extent, and furnished it with every means calculated to increase its number and its distribution, it is not a matter for surprise that an insect with its habits, and which has no aversion to the living Para tree, does attack the rubber trees which are planted in the midst of such an infected area."

Mr Pratt proceeds to explain the most effective methods of exterminating the pest and ends with a warning as to the future. He says :—

The great majority of estates in the F.M.S. are between the ages of 1-6 years, and the damage that will be caused by gestroi on these various estates rests entirely with their respective managers. Those planters who take steps to eradicate the insect from their young clearings will be more than repaid in the future. The amount of money spent in freeing the estate from this pest will depend on several factors, as for instance the nature of the soil, the formation of the land, the age of the clearing, and whether the burn was good or bad, all of which have direct bearing on the prevalence of this insect. Once eradicated the planter need have no fear of its return as a pest, but I would strongly urge the importance of taking stringent methods against gestroi on those low-lying, heavily-timbered soils recently opened. Unless this is done on land of this character probably 20 per cent. of the trees will be lost in the course of 6 or 7 years. There is, however, absolutely no cause for alarm even on these places. As yet they are young clearings, and if the managers of such estates are provided with the means to rid their plantations of gestroi there are no reasons why these places should not be quite free from the pest in the course of three years.—*Straits Times*, July 8.

A NEW FUNGUS-PEST ON PARA RUBBER.

DISCOVERED IN PERAK.

I have recently received from a planter in Perak portions of the branches and boughs of Para rubber trees destroyed by the attacks of a bark fungus hitherto unknown to me. The attack commences on the shoots which presently turn black and die, and the disease continues to descend to the trunk of the tree which eventually perishes. On examining the bark attacked, there can be seen numerous raised spots, which split and show a black fungus pushing out in the crack. In some places the bark is quite thickly marked with short straight cracks parallel to the axis of the branch. In older parts of the branch the grey bark is covered with larger elevated patches, black in colour and looking as if soot had been thrown on the tree. The CAMBIUM IS DEAD AND BLACK, THE WOOD DRY, and soon perishes. Examination with the microscope shows that in these black patches are round spaces (perithecia) imbedded in a black mass, (stroma) from the interior of which are discharged large numbers of oval spores, mostly transversely divided. The fungus evidently belongs to the group of *Ascomycetes* and appears to me to be allied to a genus *Cucurbitaria* parasitic on the Laburnum in Europe in much the same way as this fungus attacks Hevea here. The correspondent who sends the specimens writes: "Trees with apparently the same disease are dotted about the estate singly and in groups. I am CUTTING DOWN ALL THE DISEASED TREES TO THE POINT WHERE THE LATEX EXUDES healthily. This cutting back appears to stop the disease as the stumps shoot again in about 7 days. The disease appears to be a bark or leaf one as the death seems to start from the tip or tips of the branches and travels down the tree and if left alone in a short time will completely kill it." Of one specimen he writes: "The tree I send you was alive 12 days ago and yesterday I had to cut it back 4 inches from the ground to get to healthy wood. The

tree is little over 2 years old." From this I gather that the disease is very rapid in action. In a later letter he says : "The fungus appears to be ripe in the wet season, and seems to be either dying or stationary during the now dry season. The trees are planted 15 feet by 15 in hilly land. The

DISEASE APPEARED IN THE HEAVY RAINS

of March, April and May. The particular tree I sent you was apparently wintering when I left for Singapore on 11th of May and was dead to within 5 inches of the ground on my return on the 23rd. It was 2½ years old." There can be no doubt that this fungus might prove a very serious pest especially in the case of large trees where in an estate it would be both difficult to detect at first and troublesome to get at. Planters should therefore in going over their estates watch very carefully to see if there are any trees beginning to go at the top, branches dying and blackening. If so, they should be at once cut off and as quickly as possible burnt. They must not be left lying about, or the spores will be blown by the wind on to other trees. The spores in the specimens before me are extremely abundant, and one fruit of the fungus contains enough to infect half the trees in the estate. Should this pest become aggressive in an estate, it might be advantageous to check it by

SPRAYING WITH BORDEAUX MIXTURE

which would destroy the spores ; and this would be especially valuable in the case of big trees affected, as it is very difficult to cut back the end twigs in an adult Para rubber as the branches are too thin an brittle to bear an operator. For big trees a full sized spraying machine would be required as they rise to 60 or 80 feet in height ; such a machine as is used in spraying orchards in America. In cutting back the infected boughs the planter must be careful to cut far enough back. The mycelium running in the cambium layer as it appears to do is probably considerably below the point at which the sooty fruit is produced, and even below the point at which the bark appears definitely dead. I would suggest too that the bark of the infected tree round the place where the dead tree is cut, and the branches of any neighbouring trees should be treated with Bordeaux mixture to prevent any further infection by spores.—*Straits Agricultural Bulletin* for July.

MR. JAS. RYAN ON RUBBER PACKING EXPERIENCE.

A very interesting article from the pen of Mr James Ryan appears in "The India Rubber Journal" on the important subject of "How should rubber be packed ?" "Before me as I write," he remarks, "are two samples of rubber which, as our volatile friends across Channel would say, give one furiously to think They were both originally cut from the original block of Lanadron rubber which attracted so much attention at the first World's Rubber Exhibition at Peradeniya, Ceylon, and deservedly won for Mr Pears the gold medal for the best rubber in the show. Two and a half years have passed since then, and, side by side these twin samples have journeyed far from the mother creeks of Johore to Ceylon, to Burma, up the length and across the breadth of India; they have seen the dam at Assouan and wandered from the toe of the boot of Italy through Switzerland and France till at last they have come to anchor in the City of London.

"They have known every gradation of temperature, from 90 deg. F. at dusk in the damp heat of Bombay to a bone dry 10 degrees below freezing point in Rome, from 7,200 ft. on the Horton Plains of Ceylon to the subterraneous tombs of the Pharaohs and the catacombs of the Apis Bulls at Sakkara. But though treated identically (with but one exception) how differently have they behaved ! The one remains clear amber-brown, tough, elastic and resilient as the day it was turned out of the screwpress; the other is black, soft, and sticky—more like half-chewed toffee than rubber, and obviously valueless from a commercial point of view. What is the difference of treaament which has caused the one to successfully resist so many changes of climate of temperature, and of hygroscopic variation—to improve it at least in so far as to prove its permanency of good qualities, whilst the other is valueless, except as a warning how very easily good stuff can be spoiled by bad, though well intentioned, treatment? As a matter of fact, the good sample has merely been carried about loose in a kit-bag or in a suit-case. Very rarely has it been even wrapped in a bit of paper. On the other hand, the piece which has gone so hopelessly tacky has been carried in an air-tight metal case, and has been prevented from shaking about by being fixed to the lid. The process of degeneration set in within three weeks."

From this it may be judged that much has yet to be learned in the way of suitable packing for shipment of raw rubber.

PINE-APPLE FIBRE.

It is strange, a correspondent writes, that in a country where pine-apples grow as easily as they do in Burma attempts do not seem to have been made to utilise pine-apple fibre. In the Philippines a very beautiful material is woven from it. It surpasses flax-fibre in strength, fineness, and glossy appearance. Trials made some time ago at Singapore showed that whilst a certain quantity of flax fibre would support a weight of 260 lb the quantity of pine-apple fibre would support 350 lb, It also resists damp so that ropes made from it can be immersed in water for any length of time without suffering damage. The process of bleaching destroys adhesion between the bundles of fibre and spinning can then be proceeded with as in the case of flax.—*Rangoon Advertiser*, June 30.

COTTON CULTIVATION IN BATTICALOA.

Mr O'Grady of Karative estate planted 35 acres of cotton at Karative during the last year and we are glad to know that he has had a successful crop, fetching 10½d per lb. Mr Sinnalebbe of Punnaikuda also tried the same species (Egyptian) and though much attention was not paid by him to the improved methods he had a crop which fetched him 8d per lb. The land where it was cultivated, was in both cases close to the sea. We learn that there are several who intend cultivating cotton on a large scale during the coming wet season.—"Lamp," July 17.

RUBBER IN THE FAR EAST AND THE AMAZON.

A VIEW FROM PARA.

And now about the competition of Ceylon and the Malay States as producers of rubber of a type produced in the past only in the Amazon region. To my mind the British investor in rubber labours under a great mistake in regard to Brazil, not unnatural in view of the failure of London Companies organised to exploit forest rubber. But the Managers sent out from London have attempted to control the business on London ideas, without recognising the possibility of learning from the Brazilian. In Ceylon the Britisher is at home, and his rule is supreme ; he has no competitor there ; he produces rubber and sells it at a profit. The wish being father to the thought, he indulges in visions of the ignorant Brazilian native, with his lack of system, gradually being forced out of the business of producing rubber, after which the Far East will have a monopoly. "We can grow rubber at a shilling or less a pound in Ceylon," they say ; "can you beat that in Brazil ?"

No man today knows the *cost* of a pound of rubber in the Amazon country, either on one *seringal* or in general. In a land where no money circulates, this man or that taps so many trees, cures his rubber, and gets from the *seringal* store enough to eat, some clothes and tobacco. The cost of rubber does not interest him ; its selling price is nothing. So with the proprietors : the world needs rubber, and in a few years trading in it brings him a fortune.

But suppose rubber prices should drop to half —something of which at present there is absolutely no indication. On the thousands of carefully laid out *seringals* of the Amazon are millions and millions of mature and productive trees, yielding rubber which has never been wholly equalled elsewhere in the world. They are owned by people who have capital, and are skilled in business and adaptable to circumstances. While temporarily lower prices may disturb business conditions, a permanently lower level would mean simply that the *seringueiros*, still in goods, would be credited with, say, 2 milreis instead of 4 milreis per kilogram on the books of the *seringal*; they might become less extravagant, and the proprietor might lessen his rate of profit on the goods dispensed ; but so long as the trees are here and the rubber workers on the ground, there will be capital available whereby the natives will be able to sustain life by their labour, the capitalists will profit, and the Government will derive revenue from the business. The consolidation of the business of *aviador* and *seringal* owner is a step toward the possible new condition.

Another point is that the ability now of rubber producers to store their product when prices are unfavourable, thus rendering the market more stable, will lessen the risks involved in rubber trading, and the necessity for "long" profit on goods. But more than this : With such returns as have been obtainable from rubber in the past, little thought has been given to other production. Why trifle with growing food when it can be imported, with the world eager to throw money at Brazil for rubber? All hands, then to collecting rubber ; and when the rivers rise and stop rubber work, they can live from the store supplies until next crop season. Already, however, on the better *seringals* cattle have been introduced for the supply of meat and crops are being cultivated to take the place, in part, of imported food.

I have not figured out here the cost of a pound of forest "Para" rubber ; the difficulty of doing this is, I think, plain. But the reader who has entertained any idea of the disappearance of rubber gathering from the Amazon country may find in my article reason for less confidence on this score.

GUSTAV HEINSOHN.

Para, May 19, 1909.

—*India Rubber World*, July 1.

RUBBERS FIGURES, 1909: TO END OF JUNE.

STATISTICS IN TONS OF PARA GRADES FOR MONTH OF JUNE, 1909.

(Including Peruvian).

	Receipts at Para.	Shipments to Europe.	Shipments to America.	Liverpool. Imports.	Liverpool. Deliveries.	America. Imports.	America. Deliveries.	Continental. Imports.	Continental. Deliveries.
During June, 1909	1570	960	920	1102	1189	1620	1460	140	270
Do do 1908	1660	1050	1110	984	1427	1530	1680	350	400
Do do 1907	1500	1100	930	958	1101	880	970	510	480
Do do 1906	1650	830	700	799	907	600	690	340	370

NOTE.—The Receipts at Para for June, 1909, show a decrease of 90 tons against June, 1908.

The Shipments to Europe for Juno, 1909, show a decrease of 90 tons against June, 1908.

The Shipments to America for June, 1909, show a decrease of 190 tons against June, 1908.

Liverpool Imports for June, 1909, show an increase of 118 tons against June, 1908.

American Imports for June, 1909 show an increase of 90 tons against June, 1908.

English deliveries for June, 1909, show a decrease of 238 tons against, June, 1908.

American deliveries for Juno, 1909, show a decrease of 220 tons against June, 1908.

WORLD'S VISIBLE SUPPLY ON JULY 1ST, 1909.

	1909. Para.	1909. Cauch.	1908.	1907.	1906.
Stock in England, 1st hand	109	—	868	796	739
Do do 2nd hand	205	—	356	148	187
Stock of Caucho in England	—	798	1240	608	299
Stock in Para, 1st hand	50	20	180	30	—
Do do 2nd hand	190	10	250	170	230
Do America	380	410	510	570	550
Do on Continent	10	20	250	170	560
Afloat to Europe	480	290	570	810	490
Do America	100	60	410	300	390
	1524	1608			
TOTAL	3132		4634	3602	3445

NOTE.—World's visible supply on July 1st, 1909, shows a decrease of 1,502 tons against July 1st, 1908.

Stock in U.S.A. on July 1st, 1909, shows an increase of 280 tons against July 1st, 1908.

Stock in England on July 1st, 1909, shows a decreaso of 1,352 tons against July 1st, 1908.

Stock in Para on July 1st, 1909, shows a decrease of 160 tons against July 1st, 1908.

CROP STATISTICS, 30TH JUNE, 1908, TO 30TH JUNE, 1909.

	1908-9	1907-8	1906-7	1905-6
Para Receipts	38,090	36,650	38,060	34,490
„ Shipments to Europe	19,200	21,740	19,300	20,125
„ „ America	19 050	14,670	18,730	14,295
England Landings Net	13,932	15,731	12,622	13,528
„ Deliveries Net	15,284	14,928	12,295	13,049
America Landings Net	20,520	14,560	18,420	13,660
„ Deliveries Net	20,215	14,600	18,400	13,880
Continental Imports Net	3,660	4,615	4,915	5,640
„ Deliveries Net	3,880	4,535	5,305	5,160

STATISTICS OF ALL GRADES.—FOR JUNE, 1909.

LONDON.	Imported. Tons.	Delivered. Tons.	TOTAL STOCK. 1909. Tons.	1908. Tons.	1907. Tons.
East Indian, Borneo, &c.	79	58	164	184	326
Plantation (Ceylon, Malaya, &c.)	265	301	183	178	153
Mozambique	4	28	32	67	58
Madagascar	4	4	6	69	174
South American and West Indian	62	32	88	317	180
African & other kinds	8	5	26	58	78
	422	428	499	863	969
LIVERPOOL.					
Para	542	823	314	1,210	942
Other Grades	943	834	1,235	2,064	1,322
	1,486	1,657	1,549	5,284	2,264
Total England	1,907	2,085	2,048	4,147	3,233

WM. JAS. & HY. THOMPSON,
38, Mincing Lane, London, E.C.

TREATMENT OF BAMBOO PULP.

Messrs. James Scott Turner and Arthur Wellesley Maxwell have applied for a patent for improvements in or relating to the treatment of bamboo pulp and other similar materials:—

This invention relates to the treatment of bamboo fibre so as to render it fit and ready for commercial processes of bleaching. It is not intended that this treatment should constitute a method of bleaching; but it is claimed that ordinary matured bamboo hitherto commercially unbleachable is rendered bleacbable thereby.

According to this invention the method of preparing bamboo and the like for bleaching consists in steeping bamboo pulp in sea water or other suitable salt solution containing oxygen in solution, sulphuric acid or other acid being added, washing the pulp and then steeping it in a weak alkaline solution.

"We take a solution of brine, preferably made by adding salt to sea water, and pass it through the apparatus hereinafter described, whereby it is electrolyzed by a current of adjusted voltage, part of the water is decomposed, the lighter gases are released and expelled, and oxygen is absorbed by the brine and the various chlorides present. We also take a solution of water and sulphur dioxide and pass it through another but similar apparatus, where it is treated in the same way, the nascent oxygen being absorbed by the sulphurous acid, and the lighter gases, not held in solution, released and expelled. We now run both solutions together into the mixing vat or reservoir presently to be described, and in the resultant yellow solution we steep the bamboo or other pulp for a suitable period, that is, until the whole mass becomes of a bright lemon colour. The mass should be of a light yellow and not of an orange colour. In the resulting yellow solution nascent oxygen is produced, and upon this the action referred to depends. The yellow solution is now drained off, and the pulp is removed and thoroughly washed. No sediment or solid matter is given off at this stage. Both solutions and washed pulp remain of a bright yellow colour.

"What probably forms, when sulphuric and certain other acids are added to solutions of chlorides containing oxygen in solution, is an oxy-acid of chlorine which again liberates, in contact with the fibre nascent oxygen which combines with the coloured film or pellicle that is sought to be removed without free chlorine being produced.

"We now prepare a weak alkaline bath of limewater or caustic soda, or a mixture of carbonate of soda and borax, or other suitable alkali, and in this bath we steep the pulp (already steeped and washed as before described) for a suitable period or until the whole mass becomes of a dark brown colour. The pulp is now removed and again thoroughly washed, and this time the whole of the objectionable film, which has now changed its chemical composition and lost its power of adhesion, is run off along with the dark coloured liquor, and a well-cleaned cellulose, free from encrusting matter, remains.

"The pulp can now be bleached in any suitable manner, for example, in a much-diluted solution of the yellow solution obtained as above referred to. Or it can be bleached in a 2 per cent solution of ordinary bleaching powder, which now causes no injury to the fibre. No other fibre at present in use for paper making can be bleached with such a weak and therefore inexpensive solution; most require say an 8 per cent or 12 per cent solution."

The apparatus preferably employed is described and illustrated; consisting of a divided trough in which the electrolytic action is carried out and a vat having a stepped cone for further freeing the gaseous particles not freed by the corrugations of the electrodes in the trough.

The method, the treatment, and the apparatus are claimed.

Thirteen claims: three sheets of drawings.—*Gazette.*

THE COCONUT CROP INCREASE: AND RISE IN OIL.

Marawila, July 25th.

DEAR SIR,—I do not agree with the conclusions you drew recently in your review of the coconut industry, as to the causes of the increase of nuts. I have not your article before me; but I believe you wrote that the drought, instead of being detrimental, was beneficial to coconut cultivation.* That the very severe drought in the North-Western littoral has reduced crops and affected the quality of the nuts is an undoubted fact. The increase in crops is due to the thousands of acres that are annually coming into bearing. I quoted recently from the letter of a V.A., who, in a motor drive along the high road to Puttalam, saw thousands of acres of young coconut plantations. Inland, there are very many more.

A correspondent in your columns recently said that the rise in the price of copra was due to the rise in the price of oil. Why not the other way? Oil is extracted out of copra. If the price of copra rises, the price of oil must of necessity rise with it.—Yours faithfully,

B.

[* What we wrote was that while short rainfall caused falling off in quality of kernel, there was little if any decrease in number of nuts; a somewhat different statement.—ED. *C.O.*]

COPRA INSPECTION IN FIJI.

The following is a draft of a letter forwarded by the Levuka Chamber of Commerce to the Honorable the Colonial Secretary, Suva, *re* the suggested appointment of Copra Inspector:—

"Sir,—I have the honour under instructions from my Chamber to reply as follows to your letter on the above subject. Your letter was carefully considered and discussed at a special meeting of this Chamber. The subject is a difficult one and the questions you ask cannot be answered off-hand. In the first place we must make the following admissions:—

(a) The copra exported from this colony is not, on an average, of the best quality and does not command the best price in the world's markets.

(b) Under present conditions there is no inducement for producers to improve the quality of their output, because copra is not graded in the local market and first class realises no higher than poor quality.

(3) Some system of inspection and grading would probably bring about an improvement in the average quality of the copra produced in the colony and thereby lead to the realisation of higher prices for this commodity.

I may say, therefore, that in theory this Chamber would favour the appointment of a Copra Inspector; but we recognise the many practical difficulties which must be faced. This Chamber contains several members who have for many years been deeply interested in the copra trade as traders, buyers and exporters, and yet we find it very difficult to work out the details of a scheme by which effective inspection and grading of copra would be secured without greatly hampering and harassing the exporter. To secure effective grading, every sack of copra must be marked—and that means a large amount of work for an Inspector at each shipping port. Copra exporters would have to be licensed in each port. We think the best way to recover the cost of inspection and grading would be to treat each port separately and divide the salary and expenses of the Inspector *pro rata* amongst exporters in proportion to quantity of copra shipted by each. Before expressing a more definite opinion than that contained herein, the members of my Chamber would like to have an opportunity to consider carefully the details of any suggested scheme. Meanwhile we wish to take this opportunity of impressing upon your Government the fact that a very large proportion, of low grade copra exported from Fiji, is made by natives and that a substantial improvement in this direction could be effected if the Native Office would take the matter up and urge upon Rokos, Bulis, and other native officials the necessity for more care in the making of copra. We suggest that in many towns it would be advisable to erect drying sheds with proper *vatas*, so as to replace by a more up-to-date system the present crude and wasteful methods."—*Fiji Times*, June 30.

FARMING OUT RUBBER TREES.

At Three Dollars a Month.

According to a native report, certain owners of rubber trees in and about the town are farming them out at $3 per tree per month. Even at this price, there should be a good profit with rubber where it is.—*Malay Mail*, July 22.

TEA AND RUBBER IN TRAVANCORE.

Mr. H. M. Knight's Opinions.

Yields of 5lb. rubber per tree.

In a conversation one of our representatives with Mr H M Knight, the veteran Travancore planter, who was going home after having sold all his estates to Mr A Lampard, of Messrs. Harrisons and Crosfield, he learnt that practically all the land which was suitable for rubber growing in Travancore had been taken up.

"There have been very great difficulties in getting the land," said Mr Knight, "and now there is practically none available under the present conditions. Rubber is doing exceedingly well and extraordinary yields are being given. I am told that some trees, only about 10 years old, have given up to five pounds a tree. From my own experience I can say we are getting most extraordinary tea yields. On Surianalle I have been getting 900 pounds an acre at 5,000 feet elevation."

The Estates Sold.

Four estates were sold by Mr Knight, most important being Surianalle in the higher ranges. 538 acres of this are under tea and there is a balance of 793 acres, making 1,331 altogether.

Lockhart, which is nine miles west of Surianalle, on the same range of hills, but a little lower down, contains 279 acres under tea, and 120 under coffee, the balance being 321 acres, making 720 altogether.

Manale, which is in the same valley, on the opposite side, has 218 acres under tea, and 20 under cinchona, the balance of 175 acres, making 413 altogether.

Gudampara, a cardamom garden, situated in the Cardamom Hills, ten miles south of Surianalle, has 627 acres under cardamoms, and 19 acres grass land, 646 in all.

TEA TRADE IN BATOUM.

Tea planting in the neighbourhood of Batoum continues to progress slowly. Land under tea cultivation is annually increasing, and, although private tea growers have, for the most part, abandoned their enterprises, yet the Imperial Domains authorities continue to augment the area of their plantations. The quantity of tea collected during the year 1908 and three different periods was as near as possible 203,000 Russian lb., or 200,700 English lb., all of which was bought up for the midland markets of Russia and none was exported. The tea is of fairly good quality, but lacks the aroma which is so prevalent in Chinese teas, still it makes a good beverage, and a number of persons inspired with patriotic feelings appear to prefer the taste of it to China, India or Ceylon teas. Pioneer tea growers along the coast here are now making an attempt to prevail upon small farmers and the natives to include small tea plantations in their agricultural pursuits, but it is difficult to forecast success in a scheme of this kind. At any rate, it will take considerable time to persuade the native into growing anything but maize within the limits of his allotment.

The imports of tea from China, India and Ceylon during the year 1908 exceeded all previous records. Of course, most of the tea went to Russian possession in Central Asia, and notwithstanding the troubles in Persia a considerable quantity was forwarded to towns in Northern Persia. Indian teas were mostly sent to the province of Azerbaidjian and to Tabriz. There were, in all, eight Volunteer Fleet steamers that brought Chinese teas to Batoum during the year 1908. Together these vessels landed over 130,000 half chests of tea.

Indian and Ceylon teas principally found their way to Batoum by Austrian-Lloyd steamers and by steamers of the Russian Steam Navigation Company, which took them over at either Port Said or Alexandria from Peninsular and Oriental Company's steamers and other British vessels.

The quantity of Indian and Ceylon teas imported for consumption in the Caucasus was 221 tons, and for passage through the Caucasus to Persia and Central Asia was 10,072 tons. Apparently, in course of time, this trade will develop and assume even more extensive proportions than it has hitherto done. The demand in Northern Persia for these qualities of tea is steadily increasing, and when the country becomes pacified there is every likelihood of further development in the trade.

From the Consular Report on the Trade and Commerce at Batoum (Russia) for 1908, by Mr. Consul P Stevens.—Indian Trade Journal, July 8.

RUBBER PLANTING IN MALACCA.

INTERVIEW WITH MR S W MOORHOUSE.

In view of the rapid strides which rubber-planting is making in the Straits, particularly in Malacca, where the catch crops are such useful products as tapioca and gambier, from which the well-known gamboge dye is produced, an interview which an *Observer* representative had with Mr S W Moorhouse, who has had great experience in that part of the world, is of especial interest. Mr Moorhouse, who has for several years been on Diamond Jubilee estate in the employ of the London Asiatic Rubber Co. is so convinced of the prosperity which lies before planters in that district that he has

STARTED A NEW COMPANY ENTITLED "PEGOH LIMITED."

The estate of Pegoh which has an total area of about 3,300 acres has 2,100 acres which have been opened up by Chinese and have upon them rubber about six years old and in splendid condition.

PRICE OF RUBBER: SETTING CROPS FORWARD.

Asked as to how high they in the Malay States expected the price of rubber to rise, Mr Moorhouse said: When I left they were talking about 7s. and I see it is up to that already. That was about as far as they thought it would go and the general opinion was that it was very good at that.

Is there much setting of crops ahead on contract on the part of Companies?—I have heard of about seven or eight companies setting their crops forward, mostly through Colombo. It is nearly all done through Colombo; very little is done in Singapore. I have not heard of any private proprietors setting their crops forward.

PLANTING GENERALLY.

To what extent is actual planting going forward in the Malay Straits?—They are planting practically everywhere. There was rather a check two or three years ago when the prices went down; but now they are planting all over. In Malacca there is a lot of planting, though there is not so much in Selangor. On one estate I know in Malacca they have planted over 3,000 acres during the last two years.

LABOUR.

How do you get on with regard to labour?—Where I am there is any amount and always has been. We employ a great many Chinese in addition to Tamils. The place to which I am now going is to be worked entirely with Chinese labour without any Tamils at all. There will be no Europeans but myself, as my assistants will be Chinese. One reason why we do not employ Tamils is that Government restrictions are so severe, and, also, they really cost more than Chinese. A Chinaman is paid a few cents a day more but it is not necessary to build hospitals for him, or pay assessment, or do the many other things which have to be done for Tamils.

How much do you pay him?—Forty five to fifty dollar cents a day on an average. It is piece work and they reckon to make that. It is all contract work. The Tamils get 30 cents and they are generally employed on day labour. Another great advantage of Chinese labour is that there are no advances. You never lose anything in advances to a Chinaman. If you know how to work Chinamen they are very good labour. They never give any trouble, or fight, or quarrel, as the Tamils do, and they never seem to get sick. All the time I have been on Diamond Jubilee I have never known a cooly die. They don't cost anything for medicine.

THE NORTHWAY TAPPING SYSTEM.

What have you to say about the Northway tapping system?—It does not seem to have caught on in Malacca and I don't think it will. Tapping is done so cheaply and we get such good yields that it does not seem worth while to make any change. I have not seen it tried at all. People are using just the ordinary old knives, Farrier's knife, and the ordinary gouge. Nobody knows anything about the Northway system and they want to know more about it. All I have heard is not very favourable towards it.

WEEDS AND PESTS.

Are you troubled much with weeds?—No, not particularly. I believe in clean weeding, which is cheapest in the end. They are trying the passion flower and crotalaria in Malacca and I believe the former has been a great success in many places. Crotalaria is not a weed killer but a manure. For that it is very good but for to plant it on a virgin soil is nonsense.

Are you troubled with pests?—Not very greatly. There are a few white ants. The *Fomes Semitostus* is confined to the coast and flat low lying land.

TAPPING.

Have you any decided views on tapping?—I believe in tapping every day and as much as you can but I also believe in giving the tree a rest now and again for a month at a time. Some people go in for the every other day tapping. I think that is a mistake.

FORM OF PREPARATION.

What sort of rubber do you chiefly prepare, Mr Moorhouse?—The ordinary crêpe and sheet. Malacca is going to be a very good place for turning out good quality rubber because of the good water we have there.

Mr Moorhouse comes of a family of planters. He is at present accompanied by his brother, Mr T O Moorhouse, who is opening up an estate with his father, Mr T H Moorhouso, in Johore.

ANDAMAN MARBLE-WOOD OR ZEBRA-WOOD.

From Forest Pamphlet No. 7 of the Forest Economy Series No. 2 on *Diospyros Kurzii*, Hiern by R S Troup, F.C.H., Imperial Forest Economist to the Government of India, we extract below. [The frontispiece is an excellently marked thin strip of the wood, set in a thick paper frame.]

Mr Troup, writing from Dehra Dun, 28th Jan. 1909, says :—"This publication is the first of a series dealing with some of the more important Indian timbers, many of which are at present insufficiently known in commercial circles. Similar pamphlets on other timbers will be brought out from time to time, and will contain such information as is likely to be of use to wood merchants, engineors, architects and others interested in the utilisation of Indian timbers."

VERNACULAR NAMES.—*Pecha-da*, And. ; *Kala lakri* Hind. (in Andamans); *Thitkya*, Burm. (in Andamans.)

DISTRIBUTION.—Throughout the Andamans ; also found in the Nicobars and Coco Islands, (rare, according to Prain, on Great Coco Island.)

TYPE OF FOREST.—The tree is found scattered in semi-deciduous and evergreen forests at elevations of about 50 to 300 feet, usually on low-lying and undulating ground. According to Mr B B Osmaston, it is never gregarious or very numerous. Often 1 or 2 mature trees may be found to the acre, and sometimes more, in small patches. Mr Osmaston also states that natural reproduction of the species is fair, and that artificial methods of reproduction have not been tried.

DESCRIPTION AND SIZE OF TREE.—An evergreen tree with smooth thin grey bark. Kurz states that it attains a height of 50 to 60 feet with a clear stem of 25 feet and a girth of 6 feet, but according to Mr Osmaston, this is only exceptionally the case in the Andamans, the tree reaching a height of 40 to 50 feet with a cloar bole of 15 to 20 feet and a girth up to 5 feet.

SIZE OF TIMBER OBTAINABLE.—Mr Osmaston states that logs extracted average about 2½ feet mid girth, but that as the heartwood is small, squares of over 6 inches siding are unobtainable. Mr C G Rogers is of opinion that in forest which has not previously been worked squares up to 9 inches siding could be obtained. Some years ago Mr Heinig reported that it squared up to 20 feet long with siding up to 9 inches, while Mr Ferrars gave the length as 20 feet with siding up to 12 inches. From this it is evident that the larger sized timber has to some extent been cut out in accessible localities. Mr Osmaston further states that a log of 12 cubic feet would yield on an average only about 1 cubic foot of converted heartwood. Mr Rogers believes that with regular working, resulting in the improvement of the forests, a larger proportion of good heartwood could be obtained, because many of the trees now available are over-mature, and full of faults.

DESCRIPTION OF WOOD.

Marble-wood, like the "Calamander-wood" of Ceylon (*Diospyros quæsita*, Thw.), is a variegated ebony, the chief value of which, for ornamental purposes, lies in the remarkable effect produced by alternating streaks of black and grey. Gamble's description may here be quoted.—"*Wood* hard : sapwood grey: heartwood streaked black and grey in more or less alternate layers, or rarely quite black. *Pores* small and very small, scanty. *Medullary rays* very fine, numerous, uniform and equidistant. Transverse bars very fine, numerous, irregular, faint." I have had an opportunity of examining a number of specimens of tho wood, with special regard to variations in marking The grey markings are of various shades and sometimes have a pinkish tinge. The dark markings also vary in intensity, merging from jet black, sometimes with a deep purplish tint, into brown or greyish brown. The greater the contrast between the dark and light markings, the handsomer is the specimen.

MR. HERBERT STONE'S REPORT.

In 1907 I sent a sample of marble-wood to Mr Herbort Stone, of Birmingham, the well-known specialist on timbers. He has kindly examined the specimen, and reports as follows, on it :—

"This wood is well-known to turners and makers of 'Tunbridgeware,' but it is surprising how rarely one sees it in use. I cannot recall having seen a piece of furniture in which Marble-wood was used. Nevertheless, it is highly spoken of by men in the trade, and I suspect that the irregularity of the supply, coupled with high price, may have something to do with its limited use. I do not doubt that all that can be sent over here will be readily purchased. The specimen is a very good sample and quite marketable. The greater the contrast between the alternate bands of ebony and whitewood, the more valuable it will be, and I suggest that logs in which the lighter bands are too brown should be carefully weeded out. We are now so much accustomed to seeing ebony opening brown, that logs of marble-wood in which the bands are not quite white will be taken for a very inferior ebony, and the trade will be prejudiced. Ebony, now-a-days, is not so black as it is painted, or rather stained. I found the sample hard to saw, as might be expected, hard to plane, but coming up to almost a natural polish, and excellent to turn. It is a true turner's wood and is not nearly so brittle as ebony. Polish makes the black parts blacker, which is good, but it also makes the brown bands browner, which is bad. It needs a little study and special treatment. The effect when polished is very fine. Laslett says that it is one of the handsomest timbers in the world, and I fully agree with him."

I might add, with reference to the working qualities of the wood, that a furniture-maker to whom I submitted samples in India found it by no means difficult to work, as compared with many other Indian woods.

Weight.—The weight per cubic foot has been ascertained from specimens, all of which were thoroughly seasoned. The average weight works out at 61 lb. per cubic foot (excluding Nos. 7 and 8 which consist only of sapwood and heartwood respectively).

Strength.

In 1906 Professor Everett, of Sibpur Engineering College, published the results of tests carried out on three specimens of marble-wood. The figures are higher than those obtained at the same time for teak in all four classes of tests.

Seasoning Qualities.—Messrs. Heinig and Ferrars say the wood is difficult to season and is liable to shrink and warp ; Mr. Osmaston adds that it is liable to split and warp if felled green. Undoubtedly it requires great care in seasoning, but the marble-wood planks which I have received from Andamans have shown less tendency to warp and split than planks of several other Indian woods. I selected one of these marble-wood planks and carefully measured its volume by means of a Xylometer in November 1907 and again a year later ; the shrinkage was only 0·2 per cent., which is practically negligible. The plank was a seasoned one, and the experiment would indicate that after seasoning there should be little fear of shrinkage with age.

So far the marble wood logs in the Andamans have always been kept in the sea, and the wood has therefore never had a chance of being seasoned in any other way. It is possible that girdling some time before felling, or dry seasoning, may have a better effect on the timber than salt-water seasoning. In any case it would appear necessary to season thoroughly before converting into scantlings of small size.

Price.

The price at which the wood has been supplied to the Government Workshops at Port Blair is R90 per ton of 50 cubic feet, which is far too low, as it does not even pay the cost of extraction. Mr. Osmaston considers that it would probably cost the Forest Department R4 per cubic foot of heartwood f.o.b. Port Blair, and that in order to be remunerative the price should be fixed at about R6 per cubic foot of heartwood.

A small trial consignment of 8·5 cwt. sent home and sold by auction by Messrs. Churchill & Sim in London in 1878 fetched £2-15-0 per ton weight. Regular consignments at the present day would probably bring a much higher price.

Uses of the Wood.—The wood is used entirely for ornamental purposes, for which it is one of the handsomest woods in the world. It is particularly suitable for cabinet-work, ornamental furniture, walking-sticks, fancy boxes, carving, turning, inlaid work, picture-frames and other similar articles.

WEST AFRICAN RUBBER CULTIVATION.

Sir Alfred Jones on Developments.

A meeting of the members of the African Trade section of the Liverpool Chamber of Commerce was held yesterday in the Board-room of the Chamber, Exchange buildings, for the purpose of hearing an address on "The Prospects and Possibilities of Rubber Cultivation in West Africa," by Mr. J J Fisher. Sir Alfred Jones presided. Sir Alfred Jones, in opening the proceedings, said they offered their congratulations and welcome to their friend, Mr. Fisher, who had been out to West Africa in an endeavour to utilise the British territories for the purpose of growing rubber. He was sorry to say that the British people had not made the best use of their territories under their flag. The Liverpool merchant had not been quite so smart in making money as he might have been. Ceylon and Malaya had very profitable rubber plantations, paying from 100 to 300 per cent, and it proved that the British had been very apathetic in availing themselves of a great source of revenue. In his efforts to make his rubber plantations successful in West Africa he had consulted men who had had a great deal of experience, and the African trade section of the Liverpool Chamber of Commerce had done a great deal in bringing forward the best views. They

had had Mr. Herbert Wright down to Liverpool, and Sir Daniel Morris.

There was no reason why they could not grow rubber in West Africa as well as others did in Ceylon and other parts of the world. . . . There was no doubt that other nations were ahead of them in rubber production, and the French, Belgians and Germans were producing better rubber than they were. The African trade section of the Chamber was making every effort to improve the production of rubber and encourage its growth. The Liverpool merchant was celebrated for his enterprise, and he hoped that they would show their enterprise in rubber growing. (Applause.)

Mr. Fisher—said the possibilities of rubber cultivation in West Africa were immense. In proportion to her territory the Gold Coast came first ; then the two Nigerias, Southern and Northern ; and Sierra Leone, and last the Gambia.

"Funtumia elastica"

was indigenous through central or equatorial Africa, from 13 to 15 degrees North, and not quite so far South. The supply had gradually diminished, because the natives had cut down most of the trees (in doing so they got the latex quicker and in larger quantities). They were told by the Government not to cut the trees any more, but only to tap them, and there were now agricultural instructors showing them how to do it. The idea came to some merchants that rubber should be planted in West Africa. The Germans and some French ordered seeds and seedlings from Para, but had no success after having made various attempts. The Germans then started to plant Funtumia, and had now large plantations in Cameroon beginning to

yield, and were thus several years ahead of us. They also had planted Para rubber (*Hevea Brasiliensis*), but more as experiments. Funtumia rubber was now coming to the front. A strip cut off from a biscuit 5 in. long, 1 in. wide, and about ⅛ in. thick stretched out to 35 in., seven times its length, before it broke. Funtumia olastica rubber would, therefore, take the first place, always provided it was planted and its latex sciontifically treated. Next came Para rubber (*Hevea Brasiliensis*); for West Africa an exotic tree. These two kinds were the most important. Hevea was from the Brazils and from the East. On the Gold Coast, however, the natives brought the

RUBBER FROM *Landolphia Owariensis*,

from the Eastern part of the Colony. It was a fine white rubber, which did not turn black in coming into contact with the air. So far, however, it had puzzled the planters. It took too long a time to get a tapping face on its main stem. Manihot, an exotic tree from Ceara Manicoba, would grow on drier land and on rather higher altitudes, where Hevoa and Funtumia would not do well. It was an interesting tree, and grew fast. Some species often made seed after the second year and could be tapped in the third. In Aburi, *Manihot Glaziovii* did not do well, but there the ground was too rocky and too dry. The Germans in East Africa had found that this was the most remunerative for their country there. In Ceylon also they were taking it up again after having abandoned it for some time. Of late, however,

THREE KINDS FROM MANICOBA

had been introduced (they are *Manihot dichotoma*, *M. keptaphylla*, *M. piauhyensis*) which promised much better results, and they were to replace everywhere by *Manihot Glaziovii*. The rubber came near to Para rubber. was harder but had less elasticity; its price was about 6d below Para. Last came

FICUS ELASTICA,

several kinds; the one or the other kind grew all along the coast. There was one tree which had proved very unsuccesssful. He thought no further attempt to introduce it in West Africa should be made. It was the Castilloa, a fast growing, soft-wooded tree from Mexico. In Aburi everyone had been attacked by the boreworm after good growth and withered away. Some years ago when he saw the scarcity or rather the increased demand for rubber coming on (it was the time when the Cotton Growing Association was formed) ho went to Sir Alfred and told him that rubber also, and even principally, should be grown in West Africa, and he said rubber could be grown as well as cotton, but that rubber took a long time to grow. The general opinion was then not so far advanced as it was now. It was now generally acknowledged that rubber had become a necessity as much as steel and iron, If rubber did not take so long to grow or rather to give returns, all the plantations now working and being still started would nevor havo come into existence. If rubber had been an annual liko wheat and many other products, or even if it was a biennial, it would nevor have reachod such prices as it had today. When once the trees began to yiold they went on, some as far as eighty to a hundred years, and increased in yiold up to about fifty yoars, after which they remained somewhat stationary. They required very little attention during that time. Only the Manihot family made an exception. These were at their best at about twenty years of age, some even sooner, and then declined, but these reproduced quickly, and were at their tapping stage at the age of three years. There was, therefore, plenty of compensation for the investor who could wait. Thore were

NOW ANNUALLY ABOUT 80,000 TONS OF RUBBER GROWN,

of which about 50,000 or more are good qualities. Besides this there were about

65,000 TONS RECLAIMED RUBBER CONSUMED.

It was only the fine rubber there would be a demand for, and that must be planted; wild rubbor must now decrease year by year and be superseded by plantation rubber. He meant that the 40,000 tons Para rubber coming annually from the Brazils would, as it were, be domesticated and become plantation rubber. Every treo would be cared for and qualities improved, too. And for such plantations, Africa, especially West Africa, and the territories named, had the widest and most suitable field. When rubber plantations were started, many other products would be planted with it. Fruit fibres, spices, tobacco and so on, and when with the extonsion of railways, theso could easily be brought to the ports, quantities would always bo large, and Sir Alfred would have to increase his fleet to carry them.

On the invitation of the chairman, Mr. Jamos Irvine said he spoke as chairman of the company of which Mr. Fisher was the trusted managing Director, in which capacity he had already three times visited the property since the formation of the company. The rubber grown there needed no proof now, for they all knew that in something like seven years

THE EXPORT FROM THE GOLD COAST

alone rose from £100 a year to over half-a-million sterling—that, however, was accomplished by the most reckless disregard of the life of the tree, and such treatment had been, and was still receiving, the close attention of the Government. Concurrently, and following the example of the Malay States, Ceylon, and many other tropical regions, attontion had been largely given to the systematic and scientific cultivation of the various kinds of rubber trees in West Africa chief among which two species stood out prominently, the *Hevea* from the Amazon region, known to them familiarly as Para rubbor, and the indigenous *Funtumia*, of which he would presently speak. Before planting seeds of the Para species, a close scientific study was undertaken by several experts, notably by Mr Horbert Wright, who for a year or more was the official adviser of this Chamber, and it was discovored that the climatic conditions and the soil alike were precisely thoso of the Amazon Valley. Thero was thorefore every reason to anticipato that whon the many thousands of *Hevea Brasiliensis* trees—now growing vigorously on their properties (that was the

WEST AFRICAN RUBBER PLANTATIONS, LTD.)

—had matured, say in three or four years' time, perhaps less, results such as were now so common in the rubber Companies of the East would be the pleasant experience of all who were investors in similar enterprises in West Africa. He had mentioned the Hevea species, but his own hopes centred still more on the indigenous Funtumia, which as far as experience had gone promised to yield more rubber per acre, and of a better quality. It was natural that they in that Chamber should prefer West African rubber enterprises to those in the Far East, and they had, he thought, good reason. Thanks to the efforts of the Tropical School of Medicine, the climate was probably now as healthy as in the Malay States—the

LAND COULD BE OBTAINED FOR ONE-TENTH OF THE COST

—labour was abundant and cheap, and with the railway, ere long, passing through their properties, they had every facility for doing as well as their competitors in the East or elsewhere. He had said as well as their competitors—was it known what they were doing?—let him at random take three companies, the annual reports of which had appeared within the last week or two; the Federated Selangor Rubber Company, which paid its maiden dividend last year of 8 per cent., this year had paid 30 per cent.; the Bukit Rajah, which for the two previous years had paid only 30 per cent., this year distributes 55 per cent.; the Vallambrosa, which had only paid that same amount of 55 per cent. in 1906 and 1907, this year paid the immense total of 80 per cent.

The CHAIRMAN proposed a vote of thanks to Mr Fisher; the proceedings then terminated.—*Journal of Commerce*, July 13th.

RUBBER IN THE F.M.S.

The following extract is taken from the Resident-General's report on this Federation for the past year :—

According to the Report of the Director of Agriculture, Mr J B Carruthers, the agricultural acreage of the Federated Malay States, excluding padi lands and horticulture, was planted with staple products as follows :—

Coconuts	... ...	118,607 acres
Rubber	.. ..	168,048 ,,
Coffee	... ..	8,431 ,,
Other forms of cultivation, chiefly tapioca	.	24,546 ,,
Total	...	319,722 acres

The lands under rubber in the several States were :—

Perak	.. ...	56,706 acres
Selangor	.. ..	82,246 ,,
Negri Sembilan	.. ..	27,305 ,,
Pahang	.. ..	1,791 ,,
Total	..	168,048 acres

A feature of rubber cultivation is the extent to which para rubber holds the field to the almost entire exclusion of rambong (*Ficus-elastica*), which as being indigenous, as growing freely, and as yielding a rubber of excellent quality, was regarded with favour by many a few years ago. The symmetrical stem of the para rubber tree, the regularity of its growth, the facility with which the latex can be collected and its reaction to wounds appear to commend it to those engaged in rubber cultivation.

The yield of rubber trees is, of course, a matter of the first importance, and in this connection the Director gives some interesting figures. The average yield for 1908 over the whole Peninsula the Director puts at 1 lb 15¾ oz., an increase of 11 per cent as compared with the preceding year. This he considers to be a satisfactory yield having regard to the fact that most of the trees that were tapped were in their first year. In Negri Sembilan the average was 3 lb 2¼ oz, and this as the average yield of nearly a million trees he regards as extraordinarily high. Negri Sembilan trees show a higher average than other trees because of their greater age, but the figure in question is satisfactory as showing what may be expected in respect of trees that have been tapped for two or three years.—*Malay Mail*, July 10.

RUBBER IN B. N. BORNEO.

Mr W H Penney, Protector, visited Sekong Estate on the 13th inst. He reports that the Manager has had a letter from London informing him that a recent shipment of their Rubber has realised 6s. 5d. per lb.. also that he has just received a telegram that the following shipment realised 6s. 10d. A fine plant of the latest type of Rubber Machinery has now arrived, and as the preparations for fixing up same are already made, it is expected that another two or three weeks will see it running. About 200 of the 400 acres estimated extension for this year on the other side of the Sekong River are felled; the work is steadily proceeding.

A visit was recently made to Woodford estate near Beaufort. Everything in the estate looked remarkably clean, and all the trees were doing well. The estate belongs to the Beaufort Borneo Rubber Co., Ltd. Planted area in Para Rubber about 800 acres, the trees varying in age from 3 years old. The jungle felled over and above area planted and being cleaned is 250 acres. It is expected to have over 1,000 acres planted by end of 1909 and 1,500 acres by 1910. The Company owns 8,000 acres on 999 years' lease free of rent. Woodford estate, the present estate, is about 6,500 acres. It is expected to commence tappping in 1911.

Information *re* Klias estate:—This estate is about 5 miles from Beaufort. The concession is of 500 acres and option of a further 500 acres, on 999 lease free of rent and rubber free from export duty for 50 years. Operations were started in August, 1908. The planted area to end of May, 1909, in Para Rubber and Lime is 130 acres. It is expected to have upwards of 250 acres planted by end of 1909. The proprietor is Mr Chee Swee Cheng.—*British North Borneo Herald*, July 16.